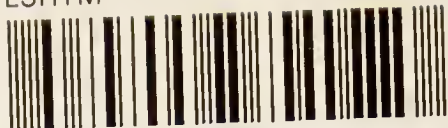


OCCUPATIONAL AFFECTIONS  
OF  
THE SKIN

R. PROSSER WHITE

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**OCCUPATIONAL  
AFFECTIONS OF THE SKIN**





# OCCUPATIONAL AFFECTIONS OF THE SKIN

A BRIEF ACCOUNT OF THE TRADE PROCESSES  
AND AGENTS WHICH GIVE RISE TO THEM

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## PREFACE

THE *terminus a quo* of this brochure sprang from the necessities of the writer. He required quickly certain particulars of the subject-matter herein contained. Complete references he found difficult of access, owing to their scattered distribution, being either buried in foreign, or out-of-the-way English periodicals.

He only claims to have arranged a needful compilation for the ready use of the English inquirer.

He trusts that he has in all instances acknowledged the source and authority of the information presented.

The writer particularly wishes to thank Miss A. Newbold for her unstinted help, especially with the German references.

WIGAN, 1915.





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# OCCUPATIONAL AFFECTIONS OF THE SKIN

## CHAPTER I

### A CIRCUMSPECTION

#### Nomenclature.

THERE has been considerable discussion as to the most appropriate name by which to designate occupational diseases of the skin.

UNNa, for example, gave the cachet of his sanction to the word "eczema" to denote skin diseases in shopkeepers, masons, washerwomen, cooks and other domestics, caused by and peculiar to their work. Clinically and structurally these lesions so closely resemble the commoner varieties of eczema as to be almost identical, and their inclusion may be warranted.

With the advances made in dermatology, however, it is not sufficient to have a similarity in the general appearance and pathology of a condition to fix its place in a scheme of classification. The causative factor must also be duly appraised. When it is found that so large a proportion of eczemas can be grouped by this means alone, surely such group is entitled to a class by itself.

An exhaustive study of eczemas in association with occupations has been made by Frank Crozer Knowles, in which he says that "fully one-quarter of all cases of eczema are of

definite external origin. Almost one-sixth of all skin cases are due to the *occupation* of the individual. The largest number of so-called occupational eczemas are seen in domestic workers, and next most frequently in labourers. Practically every occupation, and every irritant can produce an eczema.”<sup>1</sup>

In the discussion following this paper, the question arose as to whether it was worth while keeping up the distinction between eczema and traumatic dermatitis, which is often unrecognizable by clinical or histological characters. The argument was summed up by Pusey, who remarked that “the distinction was about as essential as that between natural and artificial ice.”

From the point of view of origin Dr. Oppenheim<sup>2</sup> conducted an inquiry into the diseases of the skin as they presented themselves in his practice amongst an industrial population. He examined 1,800 operatives, and found that 400 of the cases were due to the employment of the patients. Roughly speaking, this amounted to about one-fourth of all the cases that came under his notice.

The number and variety of “trade eczemas” is being gradually enlarged, and the expression is now used to designate and include many forms of occupational skin injuries and reactions, in which the clinical and pathological features are most diverse. Cases in point are plant eczema; pitch, tar, paraffin and oil eczemas; certain acute and chronic ulcerations; and the skin lesions produced by parasites, etc. It would seem that, as a term intended to express the whole group of these disorders, the word “eczema” is both incorrect and inadequate.

As our acquaintance with etiology improves, we realize that there are comparatively few true eczemas. Confusion in nomenclature is one of the greatest hindrances to the easy understanding of skin diseases. A critical inquiry into the

<sup>1</sup> *Brit. Journ. Derm.*, 1913, vol. xxv., p. 275 (Abs.).

<sup>2</sup> *Wien. klin. Wochensch.*, 1914, Jahr. xxvii., p. 63.

origin of all eczemas, and the elimination of all extraneous forms, will abolish many vague and obscure accumulations which tend so much to complicate this indefinite group, and so advance the science of dermatology.

It would, therefore, seem more convenient and logical to use the non-committal term "dermatitis." This will embrace all so-called trade eczemas, as well as the other forms of skin disease caused by employment, and where possible the name of the offending agent should be prefixed to it.

Idiopathic eczema, the causation of which has still to be discovered, would then be restricted to its own entity, and one of the scrap-heaps of dermatological terms sifted and lessened.

The existence and intensity of a trade dermatitis depend upon three factors. In order of importance they are:—

1. The potency of the irritant;
2. The resisting qualities; and,
3. The reactive capacity of the skin.

The first will be considered last. Were it not for the natural protective properties of the epidermis, the proportion of "trade dermatites" would undoubtedly be much larger.

### Resistance of the Skin.

The structure and chemical constitution of the skin render it specially able to resist the physical and chemical agents prone to injure it in practically every form of occupation. Alkalies are the chemical agents against which it has the least power of defence. The skin's toughness and elasticity are its safeguards against physical strain, but, indeed, each layer presents some special prophylactic feature.

The close union of the **cornified cells** enables the skin to resist mechanical injuries, and, when unbroken, also guards against the entrance of micro-organisms and mechanical irritants. Neither water, alcohol, nor substances dissolved



in them, are absorbed by the healthy skin, and cannot enter except through the mouths of the follicles and sweat-pores.

The "follicular" distribution of acute and chronic traumatic dermatitis is always a marked feature, and is particularly noticeable in their early stages. This can be easily observed on the backs of the hands, the knuckles being quite free from irritation, while the intervening parts are markedly affected by punctate inflammation.

**Horny cells.**<sup>1</sup>—The keratin of the horny cells withstands prolonged maceration in 50 per cent. of mineral acid, and is indigestible in pepsin and hydrochloric acid. It is soluble in weak solutions of potash, and other alkalies.

The **stratum lucidum** is not a strongly protective layer. The eleidin present both in and around the cells is slightly soluble in alcohol. It is rapidly destroyed by formalin and sublimate, is easily dissolved in pepsin and hydrochloric acid, and quickly by acids and alkalies.

The **kerato-hyalin** of the granular layer is resistant to alcohol, ether, chloroform, weak acids, and alkalies.

The **spongioplasm** of the prickle cells is unaffected by boiling water. Alkalies readily cause it to disintegrate, and it is easily digested in pepsin, according to Macleod.

Unna has shown that the coil glands secrete oil, in itself a valuable protection against chemical agents. When this substance in normal quantity pervades the healthy layers of the epithelial cells, hypertrophied by constant pressure and friction, such as is found on the palms of the hands, it is the more easy to accept common observation, and the statement of Jacquet and Jourdanet<sup>2</sup>: "That one rarely finds traumatic eczema on the palms of the hands, where the sweat and grease are abundant and well mixed. That these eczemas are

<sup>1</sup> Macleod, "Handbook of the Pathology of the Skin," 1903, p. 67.

<sup>2</sup> "Étude Étiologique, Pathogénique, et Thérapeutique des Dermites Professionnelles des Mains," *Annales de Derm. et de Syph.*, 1911, No. I., p. 12.



more common in the winter when secretion is apt to be deficient, and that fat skins are less affected than those which are thin and dry."

### Pathology.

The pathology of trade dermatitis can be defined as "the sum of the reactions of the skin to external irritation."

A process involving "loss of vitality with destruction of skin structure" is regarded as a "trade accident." With reference to trade dermatitis, until the order of the Secretary of State, dated May 22, 1907, this distinction did not hold good. For all practical purposes, the industrial diseases treated of in these pages come under the heading of "accidents." They are legally defined as "personal injuries, the result of accident arising out of, and in the course of, the employment." Many of them are peculiar to the particular industry, and the majority are specifically provided for in the Workmen's Compensation Act, 1906.

Unna states that "the entire structure down to the derma plays the most important rôle in the initiation of the majority of cutaneous diseases. The corium is subsidiary, though considerable." In trade dermatitis this remark is especially apt.

All agents—chemical, thermal, and mechanical—have a two-fold action upon the skin. They have first of all a stimulating effect, this being followed by a secondary inflammatory process. Common examples of this are to be found in the reactions to arsenic, tar, heat, X-rays, and pressure.

Adami considers that pathologically it is impossible to define sharply inflammations caused by mechanical, chemical, or bacterial noxæ. There is never any infiltration of leucocytes into the derma in true eczema, such as is seen in the severer forms of trade dermatitis.

According to Macleod,<sup>1</sup> the "first evidence of irritation to the epidermis is, dilatation of the blood-vessels of the papillary

<sup>1</sup> Macleod, "Handbook of the Pathology of the Skin," 1903, p. 151.

and subpapillary layers, with slowing of the blood-current and exudation of the leucocytes and plasma." The leucocytes infiltrate the immediate lymphatic spaces and, by positive chemotaxis they and the plasma are attracted towards the irritant. The intensity of the irritant and the poisonous products eliminated by the epidermal cells influence largely the relative proportion of plasma and of leucocytes. When the leucocytes break up, a ferment is produced which causes a deposition of fibrin from the plasma, with the formations of a serous exudate. The amount of exudation depends upon the intensity of the irritant. The exudation dilutes the irritant, and the fibrin limits the diseased area. The leucocytes are finely granular oxyphiles, with multipartite nuclei of irregular shape. If the irritation is more severe, the corium is affected, proliferation takes place of the connective tissue cells proper, and the cells of the walls of the blood-vessels. This fixed cell proliferation and exudation of leucocytes and plasma accounts for the swelling. A more persistent type of œdema, with the appearance of indurated lesions resulting from prolonged irritation, points to the presence of Unna's "plasma cells." Fatty degeneration and connective tissue hyperplasia are sequels "to either prolonged or excessive causes of irritation."

Heyde and Vogt<sup>1</sup> consider that "the absorption of burnt or damaged tissue acts as a 'foreign albumin,' and produces a state of hypersensibility, 'an anaphylactic reaction.' Burnt tissue absorbed by, or injected into, the system causes gastrointestinal hyperæmia, lessened coagulability of the blood, and leucopenia."

Trade irritants, though usually less severe, act in the same way, and this is strongly supported by Macleod's statement: "That the fibrin, formed by the death of the leucocytes, is equal in amount, whether the destruction of the skin is due to a burn, or to some chemical agent." To this absorption, small or great, must be attributed the pathological explana-

<sup>1</sup> *Zeitschr. f. d. gesamte experimen. Med.*, 1913, No. 1, p. 59.

tion of some of the very different effects observed amongst any large number of operatives exposed, under similar circumstances, to the same irritation.

Trade cytites are influenced considerably by "secondary infections," and, indeed, "it is correct to say that they stamp the character of the dermatitis."<sup>1</sup> Protection from them is weakened by even slight injury to the horny layer. Owing to the presence of serum and damaged cells, the skin becomes a specially prepared medium for their growth and development. These organisms are always the cause of pustulation, with consequent fatty degeneration of the leucocytes. In their train may follow lymphangitis, cellulitis, glandular enlargement and suppuration, as well as general infection, which often mask the original lesions. These results are attributable to the ordinary denizens of the skin, the staphylococci and streptococci. Other pathogenic organisms are occasionally inoculated.

Should the epidermis be completely destroyed by a trade irritant and the "corium" affected, an ulcer develops with its resultant scar. The edges of the ulcer become covered with a proliferation of the surrounding epidermis; its walls will be thickened by inflammatory connective tissue and plasma cells, its floor œdematous, and the blood-vessels dilated. Granulation tissue gradually fills the lacuna and the ulcers heal.

In discussing the control of occupational dermatitis and the possibility of its cure, Woodhead<sup>2</sup> shows that this is brought about by the inflammatory zone, which arrests the spread of a superficial dermatitis. Should the inflammation be deep-seated, cure is effected by the free flushing of the parts, and by an increasing number of fixed and mobile leucocytes.

<sup>1</sup> Besnier, Brocq, et Jacquet, "La Pratique Dermatologique," 1901, tome ii., p. 438.

<sup>2</sup> *Lancet*, 1906, vol. ii., p. 279.



### Predisposing Causes.

#### EXTERNAL.

The causes predisposing to occupational diseases of the skin may be external or internal—that is to say, defective “structure” or “function.”

Reaction to trauma, apart from the activity of the agent, is modified by the quality of the skin, to a large extent, and to a less degree by constitutional and bodily health. Amongst the external causes, which are manifold, may be mentioned:

The integrity of the cutaneous covering. This is the first line of defence. A normal texture and correct functioning exert a marked influence upon the proneness of each individual skin to react to external excitation.

The tender skin of an infant is easily affected, ordinary **soaps**, **Fuller's earth**, or even **blueing** in the napkins, being sufficient in some cases to set up irritation. Youth is certainly a predisposing factor. A case came under the author's notice of a delicate lad, who had to give up his occupation of a *French polisher*, because of the deleterious effect upon his skin, although it had no influence at all upon the hands of older workers.

The experimental work of Otto Sachs<sup>1</sup> has conclusively shown the remarkably high resisting power of the tougher skin of old rabbits compared with younger animals. Friction with certain irritant aniline colours proved to be almost completely innocuous to the former, whereas in the latter it caused localized inflammatory reaction, with copious exudation between the stratum corneum and the rete malpighii, and acanthosis.

Again, a xerodermatous or congenitally thin epidermis is naturally prone to become affected. With Raynaud's disease, with chilblain, feeble circulation, or other acquired or con-

<sup>1</sup> *Archiv für Dermatologie und Syphilis*, Originale, 1913, vol. cxvi., p. 555.

genital defects, such as a tendency to epidermolysis bullosum, the skin is particularly vulnerable. In ichthyosis the horny layer is rarely continuous, and the secretions are deficient. In old age, again, the senile atrophic skin is much more easily affected, and has far less power of resistance to baneful influences.

The abnormal activity of certain glands, such as the sebaceous, may heighten predisposition to the ill effects of certain substances, such as oil, tar, and petroleum. Unna says it is needful to look for any pre-existing "seborrhœa," especially pityriasis capitis, as it increases the susceptibility of the skin.

Unnaturally profuse sweating of the hands, armpits, and skin generally contra-indicate such employments as *jig-dyeing*, and *washing*. It is also prejudicial to workers amongst such substances as **chrome** and **arsenical** powder, for besides its tendency to retain irritant powders, it also assists in their solution.

Persons liable to attacks of idiopathic eczema cannot expose themselves to irritating fluids and substances with impunity, for, as Bulkley says, "all and any fault of skin hygiene may excite eczema."<sup>1</sup>

Factors of great importance, when estimating liability to injury, are the individual tidiness and cleanliness of the worker, as well as his attention to, and care of, his person and work.

These points are specially of value when considering the question as to the advisability of any person taking up, or resuming, work under conditions which are well known to give rise to cases of dermatitis.

Reflex action and toxæmias—which biochemical pathology may some day explain—probably account for some of the acknowledged differences that appear in the skin reactions to external irritants.

<sup>1</sup> *Brit. Journ. Derm.*, August, 1913, quoted by Whitfield.

### Idiosyncrasy.

An idiosyncrasy—that is, increased, decreased, or unusual susceptibility to irritants—is frequently observed in occupational diseases of the skin. It depends upon some morbid condition at present very indefinitely known. If not identical, it is closely related to the anaphylactic state. Its existence cannot be foretold, but in many of the diseases, which will be discussed later, there is strong evidence of some such influence underlying individual susceptibility.

Leslie Roberts<sup>1</sup> says that an idiosyncrasy is due to variations in the mass inertia of different skins; a healthy skin being in true equilibrium, while a diseased one is in false equilibrium.

Professor Jadassohn, in an article upon "Occupational Dermatitis," says: "Take an irritant substance which produces dermatitis on most skins, this may be a normal dose, and the skin affected normal skin. If a smaller dose produces reaction in certain skins, these are called 'hypersensitive,' or abnormal skins. We are therefore forced to believe that there is something, if not as important, certainly of importance, besides the offending agent and the structure of the skin, which contribute to the result."

Crocker<sup>2</sup> and Galloway narrate cases of hypersensitiveness to **phenyl-hydrazin**. Dr. A. J. Hall, of Sheffield, cites the following: "An analytical chemist was so easily affected by phenyl-hydrazin that the local primary inflammation by contact not only became general in a few hours, but the most minute quantity of vapour conveyed by the clothes of an assistant, who visited the chemist to report upon the work, excited an attack."

<sup>1</sup> *Brit. Med. Journ.*, 1904, vol. ii., p. 996. *Vide* also Sabouraud, "Entretiens Dermatologiques," 1913, p. 332.

<sup>2</sup> Allbutt and Rolleston, "System of Medicine," 1911, vol. ix., p. 86.



Dr. Steel<sup>1</sup> described an erythema in an infant six months old, caused by **milk**, if it touched any part of the skin. Up to six months of age the child was breast-fed by the mother, whose milk did not give rise to any trouble. Cow's milk, on the other hand, if applied to, or touching, the skin, induced a temporary redness lasting an hour. The milk was carefully examined, but was found to be quite pure and contained no preservative. Removing the lactose, or peptonizing the cow's milk, did not prevent the rash. This milk never caused any rash in other infants or children. The rash never resembled urticaria and never itched. At the end of twenty-one days the milk ceased to affect the child in any way.

Marmaduke Shield<sup>2</sup> has recorded the occurrence of **blood** erythema during operations caused by the contact of arterial blood upon the skin. Similar cases have been published by Dr. Harrison and Mr. C. Fowler.<sup>3</sup>

The dramatic death of a child, aged six, whose wet skin had been rubbed by the hands of a youth, a gardener, who had been uprooting some plants of the **poison ivy**, is related by J. C. White.<sup>4</sup> The youth himself was apparently immune.

Brocq<sup>5</sup> formulates the lawlessness of the reaction of the skin to internal agents as follows: "The same drug produces different rashes in each individual—*e.g.*, coffee and potassium iodide. The same rash can be produced in the same person by different noxious agents—*e.g.*, urticaria." At present this is unfortunately true of external irritants, but variation in the characters of the eruptions is necessarily more restricted.

An occupational disease once induced may predispose to recurrences of types of skin disease not produced by the

<sup>1</sup> *Yale Medical Journal*, November, 1900, quoted by *Lancet*, 1909, vol. ii., p. 1760.

<sup>2</sup> *Lancet*, 1897, vol. i., p. 821.

<sup>3</sup> *Brit. Journ. Derm.*, 1897, vol. ix., p. 42.

<sup>4</sup> Chalmers Watson, "Encyclopædia Medica," 1899, vol. ii., 467.

<sup>5</sup> *Brit. Journ. Derm.*, 1903, vol. xv., p. 301 (Abs.).

primary cause. Macleod<sup>1</sup> records the case of a gardener who developed acute urticaria from handling the *Primula obconica* and who subsequently was always subject to eczema, without any contact with the original excitant.

### Causes of Toxicoderma.

#### INTERNAL.

The French school of dermatologists attach considerably more importance to the influence of constitutional states and systemic derangements, in the production of skin diseases, than do their German colleagues. It is at all times difficult to allocate the part played by visceral disease or perverted function, in modifying or producing toxicoderma. Scientific explanations are wanting, and vague generalities are acquiesced in. It is recognized that any profound internal disorder is bound to exert some marked disturbance upon the nervous and nutritional equilibrium of so important an organ as the skin.

In the case of severe direct external irritants, such disturbances must be comparatively slight in their effect, and clinically unnoticeable. Nevertheless, the fact of their existence is accepted by all writers. Advanced knowledge in biological chemistry may some day offer the needful and obvious explanations. As Walsh<sup>2</sup> says: "A skin unprovided with a full supply of healthy blood is very likely to be readily affected by local external irritation and the inoculation of pathogenic bacteria."

Combalat<sup>3</sup> states that digestive disorders and constitutional diatheses, such as the rheumatic, lymphatic, alcoholic, or nervous, affect the relation between the time of exposure, and the onset of symptoms.

<sup>1</sup> Klocker, "Accidents in their Medico-Legal Aspect," 1910, p. 726.

<sup>2</sup> Walsh, "Diseases of the Skin," 1913, p. 136.

<sup>3</sup> "Étude sur les Dermatoses Professionnelles," Paris, 1894, p. 14.

Blaschko lays particular stress upon the influence of idiosyncrasy in predisposing to the effects of some agents such as **aniline**.

Thibierge<sup>1</sup> considers that any special vulnerability of the skin depends largely upon its chemical qualities.

In summing up this difficult point, Sabouraud<sup>2</sup> states that "differences in the cutaneous reactions, in the same persons, submitted to the same external irritant, at different times, must be evident to all."

With the object of gauging the value of these views, Jacquet, Debay,<sup>3</sup> and Jourdanet carried out a series of experiments. They found, by the aid of bismuth meals and careful temperature charting, that any violent or too frequent contractions of the stomach caused pain, tenderness, and a local rise in the temperature of the skin. They suggest that disordered action and function of this description might easily account for the presence of some foreign protein, a toxin in the blood circulation.

Richet,<sup>4</sup> in discussing this condition, says "that almost every form of mild anaphylaxis is characterized by general pruritus and congestion. The latter can be readily seen in the mucous membranes."

Jacquet and Jourdanet<sup>5</sup> later made a further number of valuable clinical investigations to elucidate this particular question. Their cases included *washerwomen*, *housekeepers*,

<sup>1</sup> Besnier, Brocq, et Jacquet, "La Pratique Dermatologique," 1902, tome i., p. 432 *et seq.*

<sup>2</sup> "Dermatologie Topographique," p. 384.

<sup>3</sup> "La Surdistension et le Surtravail Gastrique." Lecture à l'Académie de Médecine, 7 Juillet, 1908, *Presse Médicale*, Juillet, 1908; et "Influence Expérimentale Comparée de la Tachyphagie et de la Bradyphagie sur la Digestion Gastrique," *Soc. Méd. Hôp.*, 12 Novembre, 1909.

<sup>4</sup> "Anaphylaxis," 1913.

<sup>5</sup> "Étude Étiologique Pathogénique et Thérapeutique des Dermites Professionnelles des Mains," *Annales de Derm. et de Syph.*, 1911, No. 1, p. 12.



*polishers, cabinet-makers, and chauffeurs.* The cure of certain gastric troubles and dyspepsias was followed by great amelioration in the severity of the local traumatic skin troubles, and by the prevention of relapses.

The régime insisted upon by Jacquet and Jourdanet consisted of strict dieting, detailed attention to all errors of, or excess in, kind of food and drink, as well as in methods of eating. Their exact figures are—

Fourteen cases cured or improved by this general treatment, plus local treatment and stoppage of work.

Four cases improved or cured by this régime, without local treatment, but with cessation of work.

Nine cases cured or relieved without any local applications, and at the same time a continuance of their occupations.

Two cases unrelieved; but it was found on careful inquiry that the patients had failed to carry out the treatment.

These authors claim as an ascertained fact that the careless bolting of food, especially when this is indigestible, can by itself exercise an injurious influence upon occupational eczemas, proportionate to its degree. They also demonstrate that irritable conditions of the mucous membrane, and overdistension of the stomach are associated reflexly with pathological states of the skin.

The relationship is thus twofold:

First, reflexly, from the disordered organ to the nervous mechanism of the skin; and,

Secondly, by the liberation of a toxin, or toxins, almost certainly some foreign proteid, which circulates in the blood-supply to the cutaneous covering; or some substance in the body fluids, as has been suggested, which unites with, or acting in symbiosis with, the external irritant, forms a virulent and quickly acting poison, a protein or chemical toxico-sis, a toxicoderma.

### Classification.

All writers on this subject have failed to find any common basis upon which to found a classification sufficiently elastic to embrace all, and at the same time distinctive enough to be of use in differentiating each of these disorders. Strictly systematic divisions are impossible, owing to the huge multiplicity of occupations and the many interests, which vary according to the point of view of the observer, the worker, the scientist, the employer, or the writer.

Thus, the dermatologist looks for a lesional nosology, dependent on structural pathology ;

The statistician or economist, one enabling him to grade the interference with wage-earning capacity.

The hygienist or prophylactician asks for one based upon remedial possibilities.

Some writers adopt a dermonosology by trades, and others found theirs upon the incriminating agents.

Other difficulties which present themselves, are the large and increasing variety of industries, the complexity and often inexact knowledge of many of the agents, the constant discovery of new processes and irritants, and the lack of distinguishing characters in the one common factor—"the skin reaction." Professor Clifford Allbutt, while admitting that classifications are naturally convenient, says they are all "fictions of the mind," especially when applied to disease, owing to the infinite gradations in nature. And one is inclined to agree with him.

Numerous classifications have been proposed, but most of them are incomplete, or include affections other than skin diseases.

Bazin's arrangement is as follows :

1. Those agents exhibiting a purely local action.
2. Substances which cause local irritation, and also general toxic symptoms.

3. Those substances which produce no general toxic effects, but irritate the mucous membrane of the respiratory tract when in powder form.

Brocq classifies his three groups of agents into—

1. Animal.
2. Vegetable.
3. Chemical.

Combalat<sup>1</sup> proposes the following nosology :

1. *Physical agents*—

- (a) Electricity : Employees in electric works.
- (b) Heat : Bakers, pastry-cooks, cooks, blacksmiths.

2. *Agents which irritate by their chemical action*—

- (1) Organic substances and well-known chemical products : Apothecaries, chemists, druggists, surgeons, grocers, dyers, painters and manufacturers of colours, washerwomen, bath attendants, masons, plasterers, and cementers.
- (2) Substances of an organic or vegetable nature—
  - (a) In the pure state : Workers in quinine, sweet oranges, and the canes of Provence.
  - (b) Changed by decomposition : Spinners of flax or wool, curriers, furriers, leatherdressers.

The nosology most recently published is that by Oppenheim,<sup>2</sup> who follows Blaschko<sup>3</sup> with some modifications. The former distinguishes the following divisions :

1. The professional stigmata.
2. Burns, corrosive ulcers, freezing (frost-bite).
3. Diseases of the sebaceous and sweat glands, and carcinoma.

<sup>1</sup> "Étude sur les Dermatoses Professionnelles," 1894, p. 17.

<sup>2</sup> *Medizinische Klinik*, 1913, No. xlix., p. 2043.

<sup>3</sup> Weyl, "Handbuch der Arbeiterkrankheiten," 1908, p. 765 *et seq.*



4. Occupational diseases of the nails.
5. Professional toxicoderma.
6. Occupational eczemas.
7. Professional infectious diseases of the skin.

### Diagnosis.

Skin affections caused by external irritants naturally have many characteristics in common. The greater number have no specific lesions and no special pathology. They exhibit the features of inflammatory reaction, any differences depending upon the volume, activity, or intensity of the irritant, and its molecular form. This last may be either solid, liquid, or gaseous. If associated with heat, the action is intensified.

The chief distinguishing features of the occupational eruptions are their groupings, situation, mode of appearance, spread, and evolution. In shape they are rarely oblong, round, or oval, and generally quite local; but this is by no means a necessity. A few eruptions extend beyond the irritated areas, and are even occasionally observed at distant parts of the cutaneous surfaces, but this is so unusual as to be a differentiating sign of the toxæmias.

According to Sabouraud,<sup>1</sup> there is commonly "a history of sudden onset and rapid course. The area of irritation is sharply outlined; marked uniformity of lesions is the rule. Exudation is excessive, and there is deep-seated œdema. The eruption predominates on the right side, and is localized on the back of both hands, the wrists, and forearms." Differential diagnosis is generally easy if the above points are kept well in view.

Diagnosis may be aided by the presence of what Oppenheim terms "professional stigmata." Thus, workers in **dinitrobenzene** and **trinitro-toluene**, especially the latter if impure,

<sup>1</sup> "Entretiens Dermatologiques," 1913, p. 383.

and mixed with common salt, get their hands stained a yellow colour, particularly marked in the creases of the palms and upon the nails, which is very difficult to remove; *dyers* have their hands and nails pigmented with the different dyestuffs; and the yellow hue of the **picric acid** worker is a characteristic feature. **Metal-dust** is found under the nails of workers in **gold, silver, aluminium,** and other metals. *Tinsmiths* and *wire-drawers* are observed to have fissures and excoriations on their hands. The skin is atrophic in those exposed to great heat from **open fires**, such as smith's, blast-furnaces and glass operatives. "Callosities" are produced by the constant handling of tools. "Pigmented scars" are observable in coal-miners, iron, stone, silver, and flour-mill employees. The "casting burns" on the top of the foot are examples of stigmata in the *moulder*, and scars of old burns are seen on the arms of "linotype" apprentices, due to the splashing of the molten metal, when dropping the old type into the melting-pot to be refounded. Oppenheim draws attention to the exceptionally long right thumb-nail in women who remove the indigo fruit from its shell. In watch and clock makers this nail, on the other hand, is short, hard, and hypertrophied, from the constant opening of watches.

Other diagnostic stigmata will be alluded to under the different trade affections.

Difficulties are likely to arise in distinguishing occupational dermatites from ordinary skin diseases, which show more or less identical sites of origin or election, for instance, scabies, and rashes which particularly affect the hands and wrists, such as pompholyx, lichen planus. Galloway<sup>1</sup> includes also exfoliative dermatitis, epidermolysis, urticaria pigmentosa, and syringomyelia, as having been mistaken for trade rashes.

It is always well to bear in mind the possible co-existence of other skin diseases. These can only be determined by a careful examination of the whole body.

<sup>1</sup> Allbutt and Rolleston, "System of Medicine," 1911, vol. ix., p. 80.

Two conditions which must always be carefully looked for, and excluded from occupational dermatoses, are seborrhœic dermatitis, and the erythematous, papular, or vesicular and pustular eczemas. Occasionally follicular psoriasis has been referred to the writer as a case of industrial dermatitis. The differential diagnosis in all such cases requires a complete survey of the patient's skin. This examination, coupled with a fair knowledge of dermatology, will effectually establish the presence or absence of an independent skin disease.

Considerable skill is often required to estimate the "degree of aggravation" caused by a particular irritant upon a pre-existing skin disease. The practical issue to be decided is, fortunately, neither the extent, nor even necessarily the bearing, of the two diseases one upon the other. The opinion requested is usually, to determine as to how far the combination prevents the workman from doing such work as enables him to earn his usual wage.

### Clinical Varieties.

The symptoms of dermatitis traumatica are either acute or chronic, and depend—*First*, upon the severity of the local stimulus; and *secondly*, upon the malignancy of any secondary infection.

The clinical appearances are particularly well described by Whitfield<sup>1</sup> as follows: In the **acute form** "the initial erythema is usually more brilliant in colouring, and acute in onset, than in idiopathic eczema. The exudation first into the corium, and then into the epidermis, causes a general thickening and swelling of the skin with the obliteration of the normal markings. The distension of the intercellular canals by serum, ruptures the connecting prickle cells, and leads to the production of varying sized vesicles. These burst, and the gummy serum exudes, forming with the

<sup>1</sup> Chalmers Watson, "Encyclopædia Medica," 1899, vol. ii., p. 471.



œdematous cells of the epidermis the resulting crusts. The more intense the irritant, the larger the output of serum. Bullæ occasionally form, and soon become pustular by the migration of leucocytes. Destruction of the papillary layer leads to ulceration, with subsequent scarring."

The **chronic form** is dry and lichenoid, with the skin diffusely reddened in appearance. The infiltrated epidermis feels thickened and harsh, and contains much less grease than usual. The normal folds are deepened, and form troublesome fissures, due to the want of cohesion, and imperfect elasticity in the diseased horny layer. The mouths of the follicles are dilated, and hyperkeratotic. The lanugo hairs are stunted and broken. Vesicles are apt to form deep down in the epidermis, and secondary pyogenic infection of the fissures is very common.

Special varieties will be described under each particular agent.

## CHAPTER II

## TRADES, CHEMICALS, AND PROCESSES

## Physical Agents.

MECHANICAL pressure is an important factor in the production of many trade skin troubles. Short of trauma, it usually leads to hypertrophy.

The results of intermittent pressure are simple hyperkeratoses, ordinarily witnessed in the finger-ends of *harpists*, *violinists*, and other players on stringed musical instruments. What is known as an acquired "false bursa" is a further result of the same process, and is probably due to a larger momentum of pressure, causing epithelial increase and subdermal synovitis.

These "hygromata" form under thickened skin, and are found in *timber porters*, *colliers*, *cobblers*, *weavers*, *blacksmiths*, *stonebreakers*, and *workers* at the lathe. In this last trade they form distinct stigmata, and are well recognized amongst *hand-turners* and *carpenters*. In both they usually develop over the bony prominences of the palm, and in the latter on the thenar eminences.

"True bursæ," such as the patella, the olecranon, and false bursæ at the heads of the metacarpal bones, become enlarged, and the fascia around thickened. Any of these formations may become infected, the underlying and surrounding corium becoming inflamed; thus is occasionally induced the suppurative "housemaid's knee," and always the "beat" knee of the collier due to kneeling. Further instances are the "beat" elbow from resting the weight of the shoulder upon the point

of the elbow while working, and the "beat" hand due to the manner in which the **pick** is held. The associated inflammation present is the chief cause of complaint.

It is very doubtful whether these infections can be caused without an abrasion of the skin. Possibly infection takes place through one of the hair or sweat follicles, but its track is generally difficult to trace.

Des Barres and Courtois<sup>1</sup> refer to callosities found on the forearms of *washerwomen*, from the continual friction against the edge of the wash-tubs. French *laundry-women* also suffer from a similar trouble at the bend of the elbow, from carrying **baskets of clothes** under one arm, the basket resting upon the hip of the same side.

*Colliers, labourers, soldiers*, and others occupied in dirty work, or those who are neglectful of personal cleanliness, suffer much from intertrigo. This appears rapidly between two opposed cutaneous surfaces. According to Sabouraud, it is a streptococcal infection, and due to the large number of these organisms normally found in protected crevices of the skin. They are encouraged by moisture and heat, and friction denuding the hard epidermic cells. The common sites are the axilla, scroto-femoral clefts, and the gluteal folds. In *colliers* and right-handed coal-navvies, this condition is also found on the outside of the forearm, and the inside of the inner part of the thigh; in left-handed men it occurs on the opposite limbs in the same positions. It is due to the constant fraying of the arm against the thigh while using the pick in their common lateral position, which is almost recumbent.

Ballantyne<sup>2</sup> states that there is occasionally an eczematous eruption in the external auditory meatus caused by particles of **stone** and **coal** falling into the ear which is uppermost, when the collier is in this reclining attitude.

*Hecklers* in flax-mills have a thickened or callous condition

<sup>1</sup> "Maladies Professionnelles," Paris, 1903, p. 110.

<sup>2</sup> "Encyclopædia Medica," 1901, vol. xv., p. 137.



of the index-finger of the right hand, which is due to pulling the **flax** out of the pins. Onychia of the big toe-nail occurs as the result of these girls working with bare feet on the greasy and damp floors.<sup>1</sup>

*Gardeners* and *hedge-cutters* are very liable to thorn-pricks, with attendant suppuration of the cellular tissue.

### Cold.

**Cold** causes contraction of the vessel walls, thus lessening the flow of blood to the part, and producing pallor of the skin. Should the cold be prolonged and severe enough, the vessel walls become completely contracted, this occlusion leading to gangrene associated with much pain, and death.

Reaction is associated with dilatation of the vessels, exudation, erythema, and œdema.

“Chilblains” and “frost-bite” exemplify this progressive condition—irritation, followed by subsequent paralysis of the nerves. The first stage shows a bluish discoloration, with sensations of cold and numbness. Recovery is associated with congestion of the part, and much itching and burning. In frost-bite, superficial blisters are apt to form, or even prolonged ulceration, with healing by scarring.

According to Knocker,<sup>2</sup> this condition is liable to occur in *sailors*, *cabmen*, workers in refrigerating chambers, *engine-drivers*, *carmen*, *explorers*, *guides*, *shepherds*, and *street-cleaners*, especially when distributing salt. Frost-bites are a serious menace to *soldiers* when “trench fighting” in cold weather. Intense pain, lasting three weeks, preventing sleep, but without subsequent gangrene, has been met with by the writer, and other variants from the classical type have been common during the present war.

<sup>1</sup> *Vide* “Photographs of Dermatoconioses,” by Glibert, p. 269; Oliver’s “Dangerous Trades,” 1902, p. 699; and an article by Purdon, who quotes Glibert, of the “Ministère de l’Industrie et du Travail,” Brussels.

<sup>2</sup> “Accidents in their Medico-Legal Aspect,” 1910, p. 913.

Dr. Byrom Bramwell,<sup>1</sup> in his article on diffuse scleroderma, says, that this disease is comparatively frequent in *stone-masons*—five out of the nine cases he has seen—and suggests it may be the effect of handling the **chisel** in cold weather.

### Electricity.

According to Malloy,<sup>2</sup> “**Electric burns** are distinguished by their freedom from pain, their asepticity, and dryness. The high temperature and their brief application account for these peculiarities. They show little reaction in the surrounding parts,” which may be, however, very sensitive to touch.

Mery and Doubousquet-Laborderie,<sup>3</sup> during their investigations, found electric burns were not painful. They are not followed by fever or constitutional disturbance, and being aseptic, they do not tend to suppurate.

Most writers agree that the continuous current is more liable to cause burns at the “positive pole” than is the alternating current.

Burns of a severe character may be found both at the point of entry (anode) and also at the point of exit (cathode). The skin is sometimes black and charred at the points of contact with the metal. Burns are usually most extensive at the anode with a continuous current. Dry skin is more liable to be injured than a wet skin, though Oliver<sup>4</sup> holds a contrary view, and says: “If the skin is moist, so much more severe is the burn.” The “ampèrage,” or quantity of electricity, must be high to cause a burn. This is produced

<sup>1</sup> *Edin. Med. Journ.*, 1914, vol. xii., p. 387. Fürst discusses “On the Epithelial Changes from the Effect of Slight Heat and Cold in Men and Animals,” *Zieglers Beiträge*, 1898, vol. xxiv., p. 415.

<sup>2</sup> *Brit. Med. Journ.*, 1900, vol. i., p. 976.

<sup>3</sup> Miles’ article, “*Encyclopædia Medica*,” 1901, vol. ii., p. 146, edited by Chalmers Watson.

<sup>4</sup> Allbutt, “*System of Medicine*,” 1898, vol. v., p. 856.

by either great voltage or long exposure. Concentrations at the point of entry or exit are necessary. The point of contact, whether large or small, affects the severity of the burn. Thus, many ampères, high voltage, long-time exposure, and smallness of the point of contact, largely modify the effect. The burn of electricity is due to the heat evolved by friction, such as occurs in a fuse.

Howell<sup>1</sup> states that of all the tissues of the body, dry skin is the feeblest conductor of electricity. The epidermis especially, probably on account of its freedom from fluid, is the chief protective part of the skin-layers. This horny layer varies in thickness, and so in its resistance in various people, and in different parts of the body. The palms and soles, due to their wealth in this tissue, form the worst conductors. In normally dry conditions the resistance of the skin rarely falls below 20,000 ohms.

### Lightning.

Howell<sup>2</sup> says that **lightning** seldom causes burns on the parts of the body covered by clothing. They are usually limited to those regions beneath some metallic object, such as a watch, coin, or keys. To a certain extent wet clothes may possibly protect the skin from injury, as they are better conductors and diffuse the current more than dry clothes. Besides the burn, there are sometimes seen peculiar arborescent markings due to the spread of the discharge, causing an inflammatory reaction in the skin over which it has passed. Sometimes no external evidence of injury is present; at others, there may be wounds as if caused by actual violence, *e.g.* the stab of a blunt dagger. Lightning burns are very intractable, and remain unhealed for weeks.

<sup>1</sup> Knoch, "Accidents in their Medico-Legal Aspect," 1910, p. 272.

<sup>2</sup> *Ibid.*, p. 359. Glaister, "Medical Jurisprudence and Toxicology," second edition, p. 185, gives numerous illustrations.



### X-Ray Dermatitis.

Very careful precautions should be taken when doing X-ray work, otherwise the results may be disastrous, *medical men, nurses, and electricians* being often the victims of acute dermatitis. The burns are very troublesome, rapidity of cure depending inversely upon their severity.

Kienboch's<sup>1</sup> degrees of reaction are useful in this connection. He classifies them as follows:—

*First Degree.*—Latent period, three weeks. No visible inflammation; temporary shedding of hair.

*Second Degree.*—Latent period, two weeks. Redness and swelling of the skin lasting one to two weeks; falling of the hair.

*Third Degree.*—Latent period, ten days. Redness, vesicular superficial erosion, vesiculation. The parts are restored to their normal condition in from three to four weeks.

*Fourth Degree.*—Latent period, under a week. Necrosis, with ulceration. Healing seldom less than six weeks.

In all conditions, except the first, telangiectases may occur. This is almost inevitable after an inflammation of the third degree. Their latent period before appearing varies between six to eighteen months after the initial exposure.

Records of injury from **radium** emanations have not been so frequent as from X-rays, chiefly, probably, because up to the present radium has been used less often. Another reason is that experience has taught the danger of these active agents. So far as is known, radium rays do not differ in their physical, chemical, or biological action from X-rays. Their value and merits depend mainly upon their respective convenience of administration.

<sup>1</sup> Ballantyne's article in "Encyclopædia Medica," 1901, p. 400.

According to Louis Wickham,<sup>1</sup> "All rays striking a cell modify its vital equilibrium. The cells undergo atrophy, and their disappearance is due to phagocytosis. Histologically, the different rays (X-rays, radium, light, and actinic) produce modifications of the same order. Clinical results contradict this finding. These latter chiefly depend upon the differences in their method of production."

Robert Abbé<sup>2</sup> states that radium has been said to have the power of curing X-ray lesions. This is supported by Mackenzie Davidson,<sup>3</sup> who considers that superficial X-ray burns are relieved by some minutes' occasional exposure to radium.

### Heat Rays.

If burns are at all extensive, they are occasionally followed by a rash closely simulating scarlet fever, for which it has been mistaken. This rash is really an anaphylactic symptom due to absorption of some protein from the destroyed tissue.

Burns of the *first degree* are caused by a temperature of about 60° C. They show slight erythema, transient œdema, pain, and tenderness.

Burns of the *second degree* are caused by a temperature between 70° and 100° C. They are characterized by painful inflammation, with pronounced transudation of fluid into the tissues of the skin. A bleb forms either at once or within a few hours; this scabs, and scarring takes place beneath it.

Burns of the *third degree* are caused by a temperature greater than 100° C. The epidermis and the deeper layers of skin are both involved; destruction follows, and an eschar forms, which is thrown off by the surrounding inflammation. Contraction takes place in the scar.

<sup>1</sup> *Arch. d'Électr. Méd.*, May 25, 1913.

<sup>2</sup> *Brit. Med. Journ.*, 1913, vol. ii., p. 501.

<sup>3</sup> Kaye, "X-Rays," 1914, p. 161.

Burns of the *fourth degree*. Here the whole thickness of the skin is involved. Cicatrization follows, with irregular scars and unsightly contractures.

In burns of the *fifth and sixth degrees* the underlying tissue is destroyed, such as muscle, bone.

1. The application of sufficient heat to the skin causes coagulation of the protoplasm of the cells. The collagenous bundles become swollen and thickened. Irregular spaces are formed by the sudden liberation of steam. The papillæ appear swollen, thickened, and spherical. The horny layer is elevated, beneath which serum mixed with blood is effused, producing bullæ. In more severe cases the blood-vessels and lymph-channels are seared and occluded. Surrounding any destroyed tissue is a zone of considerable dimensions infiltrated by leucocytes.

The severity of a burn depends upon the temperature, the medium by which applied, and the length of application. The necessity of considering these factors can be observed in the burns met with amongst *blast-furnace navvies*. Burns due to **molten slag** are always more serious, and recovery more protracted, although of apparently similar extent, than burns from **molten iron**. The average temperature of molten slag is about 2,000° F., whereas molten iron is between 2,500° and 3,000° F. This difference in injurious result is partly accounted for by the fact that slag, when molten, is a very adhesive material, and so tends to cling to the parts longer; whereas the steam engendered between the skin and molten iron appears to be sufficient to detach the metal, which speedily falls off. When "welding forgings," sand is sprinkled between the heated iron. Upon hammering, the fused **silicate of iron** flies freely. This material is very viscous, as are also the shales of **oxide of iron** thrown off when hammering hot iron.



### Sun Rays.

2. **Sun-ray** burns give rise to red patches, known as *erythema solare*, accompanied by more or less pronounced itching. In cases of prolonged exposure the skin becomes inflamed, and vesicles or bullæ arise, associated with painful sensations. The dermatitis is slow to heal, freckles and pigmentation being common. All these results are due to the **actinic rays** of the sun, and are as liable to be produced in high mountainous regions as under a tropical sun. Amongst *sailors, soldiers, explorers, and mountaineers* this disease is specially trying, and may be followed by fine scarring. *Hydroa æstivalis* is probably of a similar nature and origin.

*Xeroderma pigmentosa* commences with an *erythema solare*, leading, as Sequeira<sup>1</sup> says, to a precocious senility of the skin, with pigmentation and degenerative changes.

The *erythema* and pigmentation usually associated with *pellagra*<sup>2</sup> are of a like nature; it is sometimes seen in cachectic subjects. In *pellagra* it is considered to be one of its distinguishing features. The sunburn selects the back of the hands, the forehead, nose, and cheek.

Galloway<sup>3</sup> describes attacks of *lupus erythematosus* caused by exposure to the hot sun, as occurring amongst the *watermen* employed on the Thames steamboats.

A disease due to prolonged exposure to the heat and light of the sun, has long been known under the designation of "sailor's skin," the name given it by Unna. It is a persistent form of dermatitis due to severe climatic changes, and sets up permanent alteration in the structure of the skin, with tissue degeneration. Though comparatively rare, this is regarded as a classical dermatitis. It is particularly inter-

<sup>1</sup> Sequeira, "Diseases of the Skin," 1911, p. 45.

<sup>2</sup> *Brit. Journ. Derm.*, 1914, vol. xxvi., p. 313.

<sup>3</sup> Allbutt and Rolleston, "System of Medicine," 1911, vol. ix., p. 81.

esting, owing to its many clinical similarities to lesions of the skin caused by other irritants, such as **pitch** and **tar**.

The condition is found in *sailors* and others subjected to similar exposure. It is characterized by diffuse, persistent redness of the ears and neighbouring cutaneous surfaces. This is followed by a mottled pigmentation, which gradually becomes thickened and warty. These warty growths may ultimately develop into tubular carcinoma.

It may be accepted as an axiom that any form of irritation, if unduly protracted and of sufficient intensity short of molecular death upon a suitable soil, will in time set up malignant changes in the skin.

The "electric welding of steel" is an industry which may be a source of burns. When the **furnace** is at a greater ampérage than 200, evidences of dermatitis show themselves. It is not known whether the action is the result of the **chemical** or of the **luminous** rays. After exposure for from half an hour to an hour, intense itching sets in of the uncovered parts of the body, such as the neck, face, and forearms. This is followed by redness and in some cases by swelling, the condition resolving itself by desquamation. This state is probably analogous to a severe sunburn.

According to Greer,<sup>1</sup> the luminosity required for electric welding is equal to 8,000 candle-power, with a temperature of 7,000° F.

### Scalds.

In **scalds** the essential characters of the lesion are practically the same as in burns.<sup>2</sup>

The conditions and temperatures of hot-water steam and superheated steam, which produce lesions of the skin, seem not to have been definitely determined. Dr. Legge summarizes his views thus :

<sup>1</sup> "Industrial Diseases and Accidents," 1909, p. 74.

<sup>2</sup> Miles' article, "Encyclopædia Medica," 1901, vol. ii.

“The injuries produced by exposure to **hot liquid** are proportionate to the temperature, dimensions of the containing vessels, and the period of exposure. Burns and scalds are dangerous further in proportion to the extent of surface of skin which they cover, as well as the depth to which they extend. For instance, a severe scald of small area may be much less risky to life than one implicating a large area, but not penetrating so deeply. Death, it is said, is almost certain to follow destruction of a superficial area of the skin equal to one half of the entire body surface.

“Probably the cause is to be found in changes brought about by the heat in the blood itself, which lead to a blocking of the blood-vessels, especially of the smaller arteries and veins. If we know the temperature at which this occurs, we have, I think, a criterion for deciding the point at which the risk of scalding commences.

“A temperature as hot as the hand can bear is about 120° F. (49° C.), and water at temperatures from 115° F. to 140° F. is recommended as one of the very best means of arresting hæmorrhage for the reason given, better even than the application of cold water. On the other hand, if the temperature of the water is not higher than 110° F. (43° C.), the hæmorrhage will only be encouraged. In my opinion, therefore, it might be useful to regard any temperature of water at 112° F. (44° C.) or higher as hot liquid attended with danger.”

### Burns and Ulcerations due to Acids.

The skin is liable to injury during the manufacture of **hydrochloric acid**. When *filling, unloading and transporting* the carboys, there is a possibility of the acid being spilled upon the skin. These burns are comparatively slight, if immediately washed, compared with those incurred during the same processes in sulphuric, and nitric acids works.

Burns from **acids** are usually more circumscribed than



those from **caustic alkalies**, owing to the fact that acids cause coagulation of the tissue albumin, etc., and so are more or less self-limiting.<sup>1</sup>

The skin is stained yellow when injured by **nitric acid**, reddish or dirty brown by the action of **sulphuric acid**, and grey or whitish by **carbolic acid**.

If watery solutions of **hydrogen fluoride** or its compounds are handled in the making of hydrofluoric acid, or in the manufacture of "superphosphate," ulcerations of the skin are prone to occur. Blisters are formed similar to burns of the second degree, and, according to Rambousek,<sup>2</sup> these easily become infected. Legge<sup>3</sup> likewise draws attention to the severe ulcerations produced by this acid.

**Nitric acid** has a very corrosive action, and Leymann<sup>4</sup> gives the incidence of burns in its manufacture as averaging almost 12 per cent.

Persons mixing and sieving **nitroglycerine**, a mixture of nitric and sulphuric acid in anhydrous glycerine, suffer from ulcers under the nails and at the finger-tips; these are difficult to heal.<sup>5</sup>

According to Combalat,<sup>6</sup> the lesions observed on the hands and forearms of *painters* who use sulphuric, nitric, and tartaric acids in their work, are more akin to eczema; the solutions being less concentrated.

Barres and Courtois<sup>7</sup> described the corrosive ulcers from which *enamellers* suffer. In this occupation the metal is brushed, and then dipped in sulphuric acid.

The writer has seen corrosive ulcers produced as the result

<sup>1</sup> Chalmers Watson, "Encyclopædia Medica," 1899, vol. ii., p. 486.

<sup>2</sup> "Industrial Poisoning," 1913, pp. 53 and 54.

<sup>3</sup> Annual Reports of H.M. Chief Inspector of Factories, 1910.

<sup>4</sup> "Industrial Poisoning," 1913, p. 40.

<sup>5</sup> *Ibid.*, p. 47.

<sup>6</sup> "Étude sur les Dermatoses Professionnelles," 1894, p. 41.

<sup>7</sup> "Maladies Professionnelles," 1903, p. 105.

of making a "soldering solution" by dissolving zinc in **hydrochloric acid**.

Seider<sup>1</sup> recorded the case of a *tinsmith*, aged eighteen, with deep-seated and sharply defined ulceration on the backs and palms of both hands. These followed the cleaning of the seams of tin baths with strong hydrochloric acid. The ulcers varied in size from that of a lentil to that of a farthing.

According to Gaucher and Gaugeret,<sup>2</sup> "burns due to **sulphuric acid** may be simple, torpid, or vegetating." Thus, they describe some burns as healing as rapidly as a slight wound, leaving a simple pigmented cicatrix behind. The burn or ulcer has sharply defined edges characterized by slightly coloured rugæ proceeding from a bluish centre, and radiating into the surrounding healthy skin. Other burns heal slowly, with ulcerated and infiltrated bases. The cicatrices are similar, whether the wounds heal slowly or rapidly, and these authors think the manner of healing is pathognomonic.

The colour of the cicatrix is brownish-violet, paler in the centre, but very dark at the circumference where the retracted skin shows rugæ. The cicatrix is supple and infiltrated, and the pigmentation often extends into the surrounding healthy skin. Most of the burns healed in six weeks.

The healing process is much slower in the vegetating ulcers. The base granulates first, and eventually forms a large prominent fleshy growth, filling up the ulcer and overhanging the edges of the wound. These are of a violaceous tint, as the result of neglected or injudicious treatment. The appearances resemble "granuloma pyogenicum," caused by pus.

In works where sheets of copper were steeped or cleaned with dilute sulphuric acid, the men were frequently splashed by the acid, with resultant burns.

<sup>1</sup> *Arch. f. Derm. u. Syph.*, 1911, vol. cvii., p. 439.

<sup>2</sup> *Bull. Soc. de Derm.*, 1911, No. 1.



Paschkis<sup>1</sup> states that the erosions following the handling of **bi- and perchlorides** of **tin** solution are very similar in appearance to those caused by the application of **carbonic acid snow**.

Legge<sup>2</sup> reports that in factories where artificial manures (superphosphate) are made, the dust from the grinding mills and phosphate dens gives rise to a dermatitis in the armpits and bends of the elbows. **Hydrofluoric** and **silicofluoric** vapours are evolved in this process. Considerable heat is generated by the reaction of the sulphuric acid with the raw materials, which contain a high proportion of insoluble basic tricalcium phosphate and calcium phosphate.

### Alkalies.

**Alkalies**, and especially the caustic alkalies, have a rapid and most deleterious action upon the skin. They are extensively used in the different industries, and this fact accounts for a very high percentage of the occupational affections of the skin met with in practice.

Strong alkalies stain the skin a reddish or dirty brown colour.

One difference between acute burns caused by corrosive alkalies and acids, and those produced by heat, is that blistering is absent in the former, except in the case of **Greek fire**, which is phosphorus dissolved in carbon disulphite.

Frequent immersion in strong solutions of caustic soda or potash has a powerful influence upon the nails. Their transparency is lost, they become dull and lustreless, jagged and irregular, or cracked and torn at the edges and separated from the nail-bed. These furrows and tears rarely extend beyond the middle of the nail. Neugebauer<sup>3</sup> describes this condi-

<sup>1</sup> *Wien. med. Wochensch.*, 1912, vol. lxii., p. 2887.

<sup>2</sup> Annual Reports of H.M. Chief Inspector of Factories, 1910, 1913, and 1914.

<sup>3</sup> *Wien. klin. Wochensch.*, 1914, Jahr. xxvii., p. 39.

tion in a woman who had spent three days "cleaning photographic plates" with solution of **caustic soda**. The changes developed at once, increased progressively for some time, and were still present a year later.

Rambousek<sup>1</sup> states that in the production of caustic soda, Leymann found 13·8 per cent. of the workers suffered from burns. This probably refers to the "caustic pot rooms" in alkali works due to splashes of caustic soda.

**Waterglass** (silicate of sodium) is used in soap-making, and in the manufacture of certain washing compounds. It is also employed as a preservative for eggs. At the Vienna Dermatological Society<sup>2</sup> Seider demonstrated three cases of this dermatitis. One man, aged seventeen, whilst working in a cardboard factory, showed deep-seated, circular, lentil-sized, sharply defined ulcers on the backs and palms of both hands ("corrosive ulcers"). The waterglass is kept in a tub, and the men smear it over the rolls of paper to cement and stiffen them. It is usually regarded as non-caustic, and surgeons use it in concentrated solutions for making immovable bandages and cases, without suffering any injurious effects. Waterglass was certainly the irritant factor in the cases of corrosive ulcer referred to above, as only those men suffered who manipulated the solution (three cases were examined). Sachs attributed the lesions to the presence of unattached **sodium hydrate**.

This suggestion of Sachs was confirmed by A. Perutz,<sup>3</sup> as, after making a chemical analysis of the waterglass, he found a considerable excess of caustic soda.

Greer<sup>4</sup> states that "in the 'electrolytic alkali' process of calcium, sodium, and potassium, the secondary reactions form **hypochlorites**, and these set up a dermatitis." There are

<sup>1</sup> "Industrial Poisoning," 1913, p. 21.

<sup>2</sup> *Arch. f. Derm. u. Syph.*, 1911, vol. cvii., p. 439.

<sup>3</sup> *Wien. med. Wochensch.*, 1912, vol. lxii., p. 3107.

<sup>4</sup> "Industrial Diseases and Accidents," 1909, p. 50.

numerous variations in the "chlorine-alkali" process, but they all agree in this, that the electrolite must be warm and alkaline.<sup>1</sup>

### Dermatitis of Mixed Origin.

The cytitis of *washerwomen*, *scullery-maids*, *bottle-washers*, and domestics, such as *cooks*, *charwomen*, etc., plays a leading part in familiarizing us with this, the most common variety of traumatic dermatoses.

"Washerwomen's Dermatitis."—Superadded to the action of the **soap** and **soda**, the skin is affected by the constant maceration and softening effect of the **steam** and **hot water**. **Alkaline hydroxides** dissolve the albumin, and consequently have a caustic effect, while hot concentrated lyes are a constant source of skin eczemas.

The following description of the condition is quoted from Thibierge<sup>2</sup>: "The appearance is typical, the skin thin, smooth, and shining, the ridges seem to have disappeared, and a red coloration pervades the whole surface. The backs of the hands especially are affected."

The depths of the folds and flexures of the fingers where the stratum corneum is thinnest are easily destroyed, and the stomata of the skin appear swollen. The prickle cells are irritated, and eczema rimosum is frequent. Bazin adds further that "the rash is usually erythematous, but the predominating lesions may be vesicular. The vesicles, however, are fewer and more scattered, and the condition tends to become more chronic than idiopathic eczema. The recurrent, almost continual, source of irritation speedily causes thickening and cracking of the epidermis, with the presence of thin and adherent scales."

In persons who suffer from a weak circulation, the constant

<sup>1</sup> Blücher, "Modern Industrial Chemistry," 1911, p. 168.

<sup>2</sup> Besnier, Brocq, et Jacquet, "La Pratique Dermatologique," 1900, tome ii., p. 448.



heat causes dilatation of the vessels, which becomes permanent, and gives a dark red, or livid bloated appearance to the hands.

The French have drawn attention to the special liability there is of sores becoming infected on the hands of *scrubbers*, *barmaids*, *cooks*, and the *washers-up* of crockery and cutlery in hotels and restaurants. In these and allied trades, besides the alkalies and hot water in constant use, the **fats** found in different soaps have varying irritant properties. For example, Dr. Fred Gardner<sup>1</sup> has shown that **cotton-seed** and **coco-nut oil** soaps are more irritating than **palm** and **tallow** soaps.

A more advanced stage of this disease is described by Barres and Courtois-Suffit,<sup>2</sup> in which the skin of the hands is much thickened, showing ulcerating cracks. The tips of the fingers become enlarged, the nails of the third and fourth fingers of the right hand are raised from their bed, and become black, thick, and friable; a condition of "paronychia" is induced.

Sequeira gives a typical illustration of one of the less severe forms of washerwomen's dermatitis, when describing professional and trade dermatites.<sup>3</sup>

A condition of the skin which may, at any rate, be classified as being allied to washerwomen's dermatitis, is that known as "silk-winder's eruption," the dermatography as described by Potton<sup>4</sup> is as follows:

Certain workers, when winding the silk from the cocoons, softened in hot water, suffer from a vesiculo-pustular eruption of the hands, especially the right, and the under surface of the forearms. The condition is said to be caused by the decomposition products of the dead chrysalis, which have

<sup>1</sup> Laboratory Report, Royal College of Physicians, Edinburgh, 1913.

<sup>2</sup> "Maladies Professionnelles," 1903, p. 110.

<sup>3</sup> "Diseases of the Skin," 1911, p. 77.

<sup>4</sup> *Bulletin de l'Académie de Médecine*, vol. xvii., p. 803.



found their way into the water in which the cocoons are soaked. In severe attacks, lymphangitis of the arms, enlargement of the axillary glands, and constitutional symptoms occur. Relapses are common, their severity varying often in an inverse ratio to the first attack. The duration of the attacks ranges from five to twenty days.

Potton distinguishes three stages:

1. An erythema between the fingers, followed by smarting and swelling of the fingers, and the appearance of vesicles full of sticky serum.

2. Pustulation, especially between the thumb and the first and second fingers, associated with much pain on movement.

3. Deep cellulitis and general symptoms.

This disease is now found chiefly in Italy; in France the condition is of rare occurrence, and only appears in a mild form.

Barres and Courtois assert that no irritating organisms have been found in the worm, either alive or dead.

Vallin,<sup>1</sup> however, has suggested that the cause of the disease may be an acarus, which is a parasite of the cocoon.

The whole condition points to the fact that it is a septic infection. The prolonged nature of the work, the continual maceration and constant exposure to, and contact with, decomposing matter, permit the easy ingress of pyogenic germs with their resultant consequences.

### Salt Dermatitis in the Picklers of White Herrings.

The cutaneous lesions which are so prevalent in the fish-curing industry have been investigated and fully reported upon by Dr. Collis.<sup>2</sup> He describes the primary lesion caused by the action of the brine as being—(1) A pustular derma-

<sup>1</sup> Fabre, *Académie de Médecine*, 1900, vol. xx.

<sup>2</sup> Annual Report of H.M. Chief Inspector of Factories, 1913.

titis occurring on the underside of the forearms. This form is more commonly seen amongst the women who *salt* and *pack* the herrings, which are placed in barrels after having been gutted and cleaned; (2) deep, painful, indolent ulcers observed at the sides of the nail, on the knuckles, and backs of the hands, in size between a pin's head and a threepenny piece, more frequently found amongst the *gutters*. Secondary pyogenic invasion with inflammation and cellulitis may follow either of these lesions. The greater the concentration, the more actively irritant is the **brine**. It is suggested that certain parts and conditions of the fish may be particularly apt to set up septic infection. *Herring-cleaning*, preparatory to kippering, and the preparation of export herrings where salt is not used, do not cause dermatitis. Operatives who cure fish other than herrings with salt, and who use salt to cure sausage-skins, suffer in a similar manner. Prevention is obtained by the provision and frequent use of washings of the hands and arms in clean water.

*Flax-spinners* and *soakers*, when piecing and guiding the thread, constantly expose their hands to solutions of **chloride of sodium**, to the **sulphates** and other salts of **lime**, as well as to gummy substances through which the threads pass. Leloir<sup>1</sup> suggests that **lactic** and **butyric** acid are present in this mixture. The hands are continuously macerated with these, and the irritating action of the contained **moulds** and **bacteria**. An erythematous-vesicular rash develops, which specially affects the palmar surface of the thumb and index-finger, and also the flexor aspect of the forearm. This rash sometimes appears on the feet, as the result of the usual custom of working without boots on the wet floor. Leloir has noticed that persons of "arthritic" tendency have a special predisposition to this dermatitis, and this view is supported by Lefebvre.<sup>2</sup>

<sup>1</sup> *Ann. Derm.*, 1885, p. 129. *Ibid.*, 1889, p. 672.

<sup>2</sup> "Thesis," 1888.

In 1902, Dr. Glibert of Brussels described a condition which occurred in 50 per cent. of the *spinners*. Its specific feature is a superficial exfoliation of the epidermis without the previous appearance of erythema, vesicles, or pustules. It is attended by much itching, the skin becoming gradually more deeply involved and ulcerated after long exposure. The palms of the hands were chiefly affected. Glibert gave photographs of this cytitis which are reproduced by Oliver ;<sup>1</sup> similar ulcers have not been observed in the Belfast flax operators.

### Hyperidrosis.

Hyperidrosis—excessive perspiration—is also a condition which must be included, as it accompanies many of these types of occupational dermatoses.

J. Rambousek<sup>2</sup> has quoted a case reported by Grandhomme, in which this trouble was found amongst workers on solutions of **calcium chloride**. It may be mentioned that the powder has a strong affinity for water.

The hyperidrosis often found in *brushmakers*, and in persons preparing the bristles from the pig and wild boar, has been described by Drs. Barres and Courtois-Suffit.<sup>3</sup> The chief irritants to which the hands are exposed appear to be hot or cold water, and these authorities suggest the solutions used for dyeing. The palmar surface of the hands and fingers become very markedly red, and beads of perspiration issue from each pore. Probably the strong **alkalies** used in some of the processes are the chief offenders, and possibly the **hypochlorites**. (*Vide* Dyeing, p. 108.)

<sup>1</sup> "Dangerous Trades," 1902, p. 268.

<sup>2</sup> "Industrial Poisoning," 1913, p. 3.

<sup>3</sup> "Maladies Professionnelles," 1903, p. 104.



## CHAPTER III

TRADES, CHEMICALS, AND PROCESSES—*continued*.

## Dermatoconioses.

THE “dermatoconioses” strictly include only diseases induced by work in dry dusts. Oliver<sup>1</sup> sanctions an extension of the use of this term to cover skin affections where the exact cause is certainly disputable, such as Glibert flax-spinner’s cytitis, mentioned previously. Dryness is a purely relative expression, and probably few dusts or powders met with in the industries are irritant to the skin solely on account of their mechanical action.

In the practical working of trade processes powders are usually combined with a certain proportion of water; at any rate, as soon as a powder touches the skin, with very few exceptions, such as pure metals, which can be practically omitted from present consideration, it becomes partially or wholly dissolved in the exudations of the skin, and develops its irritant action. In common practice we obtain both a mechanical and a chemical effect.

In places where irritant dusts are most liable to settle on the skin, the inflammation will begin earlier and be more severe in character. These sites are : the hair, beard, eyelids, under the nails, upon the lips, inside the nostrils, and the flexures of the limbs. Chafing between the surfaces of the skin, or between the skin and the clothing, aggravates the condition.

<sup>1</sup> “ Dangerous Trades,” 1902, p. 268.



**Spathic ore** consists mainly of ferrous carbonate, and also contains manganous carbonate. When calcined, **caustic lime** is formed. Whilst men are discharging calcined spathic ore from the holds of ships, particles of lime mix with the sweat on the exposed surface of the skin, with resultant redness, intense irritation, and circular sores. The nose and mouth are also affected. Ulcers and pustules are of common occurrence amongst *lime-burners*, and Oliver states that **uncalcined calamine** (Zinc Carbonate) sometimes causes a similar condition. •

**Mundic** is an arsenical ore which Thorpe<sup>1</sup> describes as a yellow iron pyrite iron disulphide. The dust of this ore is said to be capable of giving rise to a dermatitis.

A. J. Atkinson<sup>2</sup> states that **copper precipitate** causes a skin eruption on the men who are employed in unloading it.

**Antimony** smelters, according to Oliver, suffer from pruritus, erythema, and vesicles which are liable to become pustular. The trouble appears in the head, beard region, eyelids, under the nails, upon the lips, and inside the nostrils. In cases in which the powder penetrates under the clothes, the flexures of the body are chiefly implicated.

At a "soap factory" in New York, W. Gilman Thompson<sup>3</sup> noted the presence of much bronchial irritation, and, except in cases where the scalp was protected, the employees suffered from intolerable itching and occasional ulceration. A **scouring soap** was being manufactured, by the addition of a silicious earth containing microscopical spicula from fossil animalculæ, to which he attributed the trouble.

In making the explosive **tetryl**, when sieving nitrate of ammonia and methyl aniline, Legge met with pruritus of the skin amongst the employees from the flying dust.

<sup>1</sup> "Metals," 1896.

<sup>2</sup> Report on Compensation for Industrial Diseases, 1907, § 10483 *et seq.*

<sup>3</sup> "Transactions of Fifteenth International Congress of Hygiene and Dermatology."

Barres and Courtois-Suffit<sup>1</sup> record redness and swelling with vesiculation around the nails in **mother-of-pearl** workers.

Sequeira<sup>2</sup> states that "the use of **silicate wool** for packing round cold storage apparatus and boilers causes dermatitis from the particles," and that frequent inspection of the workers is necessary.

According to Collis,<sup>3</sup> **cotton silicate** or **slagwool dust** is irritating to the mucous membrane of the nose and eyes, as well as to the exposed parts of the skin.

Slagwool is made by blowing compressed air, or superheated steam through blast iron furnace slag. Its irritating qualities are due to its content of quicklime, and the spicular nature of its crystals.

In a paper by Margain,<sup>4</sup> it is stated that **cobalt** ore-washers often exhibit—(1) A general hyperkeratosis of the entire surface of the palms. (2) A cribriform condition of the skin, particularly over the metacarpo-phalangeal articulations, due to the pressure of their hands upon the handle of the spade they are using, and the forcing in of the particles of ore. (3) This cribriform skin breaks down into "superficial ulcerations" with a crater-like appearance. There is usually a dry base to these erosions.

### Disease from the Reeds of Provence.

This well-known dermatopathy, locally known as "mal des cannes de Provence," was first described by Chaptal<sup>5</sup> in 1750. These reeds are used as laths for the ceilings of houses, and stacked together in heaps when still wet. While in this position, they undergo fermentation and become covered with a white powder, the fungus of the mucor family, *Sporotrichum dermatodes* (Pranchon). As the workmen strip off the bark,

<sup>1</sup> "Maladies Professionnelles," 1903, p. 105.

<sup>2</sup> "Diseases of the Skin," 1911, p. 78.

<sup>3</sup> Annual Report of H.M. Chief Inspector of Factories, 1911.

<sup>4</sup> *Brit. Journ. Derm.*, 1904, vol. xvi., p. 395 (Abs.).

<sup>5</sup> "Éléments de Chémie."

this **dry fungus** is shaken from the canes, scattered broadcast, and spreads everywhere as a fine powder. It is very irritating to any part it touches, and causes much sneezing, as well as some constitutional symptoms. The skin trouble affects the neck, face, upper limbs, scrotum, and thighs, the uncovered parts of the body being the first to suffer. The skin is erythematous, and becomes swollen and oedematous, followed by vesicles and crusting. Pustules are usually absent, but the smarting and itching are intense in all stages. The affection lasts about two weeks as a rule. The whole trouble can be prevented by wetting the canes, thus arresting the dissemination of the fungus into the atmosphere, and upon the workers. Baltus<sup>1</sup> and Vicente Gomez<sup>2</sup> have both written accounts of this disease.

According to Drs. Barres and Courtois-Suffit,<sup>3</sup> an allied dermatomycosis has been observed amongst workers in other like vegetable growths, as for instance, in the *binders* and vendors of **hay, straw, and rushes**; those engaged in "putting matting" round bottles, and in "seating cane-bottomed chairs." The symptoms seen are irritation of the skin, ulceration of the nose, and even constitutional symptoms due to the adherent spores and mycelium of different moulds. The *Mucor mucedo*, the *Rhizopus nigricans*, the *Aspergillus glaucus*, and *Penicillium glaucum* have each been blamed as the cause of this dermatitis.

### Nasal Ulcers.

These ulcers are well known in certain recognized trades where dust is engendered.

Robert Leroux<sup>4</sup> drew attention to nasal ulcers even per-

<sup>1</sup> *Ann. Derm.*, 1882.

<sup>2</sup> "Revista de Medicina y Cirujia Practicas," 1890, p. 449.

<sup>3</sup> "Maladies Professionnelles," Industrial Commission, Paris, 1903, p. 100.

<sup>4</sup> *Lancet*, 1913, vol. i., p. 1631. Extract from French Rhinological Congress.



foration of the septum occurring in **gunpowder**-workers, when manufacturing black powder, consisting of saltpetre, carbon, and sulphur. It appears to inflict microscopic traumas on a mucosa previously irritated by sulphurous compounds. This perforation requires many months for completion.

Leroux also alludes to a **chrome** ulcer caused in the making of "pyroxydine" powder. This Type J. powder is made from guncotton, with 17 per cent. of bichromate of ammonium and potassium. He says the first stage consists in a dirty yellow colouring of the mucosa, due to hæmorrhage. Then follows the formation of an ulcer, and eventually perforation. This may be complete in eight days. The ulcer is painless, and must be intentionally looked for, as subjective symptoms are absent.

**Rock-Salt Ulceration.**—Amongst the *grinders* and *packers* of rock salt, who work in an atmosphere charged with the dust of sodium and other chlorides, *e.g.*, calcium, and magnesium, nasal septum ulcers and perforation are seen. They resemble the ulcers caused by chrome dust. Müller and Roth<sup>1</sup> have both reported on these conditions.

Out of eight women examined who were engaged in *packing* salt, Dr. Collis<sup>2</sup> found five cases of perforated septum.

Rambousek<sup>3</sup> reported the presence of numerous small ulcers occurring on the mucous membranes of *basic slag grinders*. These were attributed by some authors to the high proportion of **quicklime** (50 per cent.) it contains.

In the manufacturing of **emerald green**, "aceto-arsenite of copper," the operatives suffer greatly in this respect. Collis states that hardly a sound nasal septum is to be found amongst the employees. Ulceration develops so rapidly that it is often complete in such a short period as three weeks

<sup>1</sup> *Vierteljahrsschr. f. ger. med. u. öffentl. Sanitätsw.*, vol. ix., p. 381.

<sup>2</sup> Annual Report of H.M. Chief Inspector of Factories, 1909.

<sup>3</sup> "Industrial Poisoning," 1913, p. 54.



from the commencement of work. The subjective symptoms are, as usual, very mild, merely a feeling of stuffiness in the head, with slight headache, which improves as the slough separates.<sup>1</sup>

Later, in 1910, Collis recorded two cases due to the occasional handling of the dry powder of **arsenical sheep dip**.<sup>2</sup>

The composition of this powder given by Curtice, and quoted by Lucas,<sup>3</sup> is as follows :

R	White arsenic	...	...	...	1½ lbs.
	Caustic soda	...	...	...	1½ „
	Soft soap	...	...	...	4 „

Barwell<sup>4</sup> says that the continuous inhalation of **dry hot air** is sufficient to produce inflammation of the mucous membrane of the nose, which may end in ulceration.

Legge<sup>5</sup> noted that practically all the workers in **bichromate** manufactories suffered from ulceration and perforation of the septum. He was struck by the fact that, in many cases, it was the only trouble found, and there might be a complete absence of constitutional disturbance. He examined 237 workers and found ulcers present in 107 instances and perforation in 87. He considered the condition was due to the fine dust to which the workers were exposed, especially when breaking and packing the fine crystals. This is so plentiful that as much as 3·30 to 6·30 milligrammes of bichromate dust have been found in 1 cubic metre of air at breathing level in the crushing-room, and 1·5 milligramme in the packing-house. The potassium and sodium salts are alone irritating. The lower part of the septum is never affected, and consequently the nose does not fall in.

<sup>1</sup> Annual Report of H.M. Chief Inspector of Factories, 1908.

<sup>2</sup> *Ibid.*, 1910.

<sup>3</sup> "The Book of Receipts," 1907, p. 62.

<sup>4</sup> Knocker, "Accidents in their Medico-Legal Aspect," 1910, p. 597.

<sup>5</sup> *Vide* article by Legge in Oliver, "Dangerous Trades," p. 450. Also author's article in *Lancet*, 1910, vol. iv., p. 297.

Rambousek states that very little trouble is caused by the neutral chromate salts and chromic oxides, while Pander finds that the bichromates are a hundred times more hurtful than the neutral chromium compounds.

Kunkel is of opinion that the chromium oxide compounds are only irritating when they become oxidized into even minute traces of chromic acid.

**Chrome-ore** dust itself has no irritating effect, but trouble occasionally arises during the "roasting" and "lixiviating" of the chrome ore. Dr. Buchanan says that the septum of everyone suffers who is engaged in the "purification of crystals of potassium bichromate." The ulceration starts from two weeks to three months after beginning work. It is very insidious, and the men complain of nothing except a slight feeling of soreness. This soreness of the nose is a common experience when the men first begin their work, and passes off during the first fortnight. The subjective symptoms are so slight that, unless their attention is drawn to the matter, the workmen are quite unaware even when their septum has perforated.<sup>1</sup>

When **chrome colours** are used for dyeing yarn, no ulceration or perforation has been known. The dry powder seems alone to be responsible for this lesion.

The extraordinary vulnerability of this special site (the nasal septum) to ulceration is due to the comparative bloodlessness of the mucous membrane in this situation.<sup>2</sup> Here, also, is the point of impact and collecting station for all particles, suspended in the air, which enter the nostrils.<sup>3</sup>

Legge<sup>4</sup> is of opinion that, despite elaborate exhaust ventilation when the crystals are being packed, perforation of the nasal septum cannot be avoided.

<sup>1</sup> Report on Compensation for Industrial Diseases, 1907, § 5610 *et seq.*

<sup>2</sup> Legge in Oliver's "Dangerous Trades," 1902, p. 452.

<sup>3</sup> Prosser White, "Catarrhal Fevers, commonly called Colds," 1906, p. 48 *et seq.*

<sup>4</sup> Annual Report of H.M. Chief Inspector of Factories, 1913.

### Drysalter's Itch.

Another large and comprehensive group requires consideration. This is sometimes known as "drysalter's itch." It is usually held to include within its wide range such varied affections as the cytitis of *chemists*, *druggists*, *grocers*, *bakers*, *sugar refiners*, the skin troubles due to the preparing and packing of sweets and fruits, as well as in the trades of *plasterers* and *masons*.

Drysalter's itch is of fairly common occurrence amongst *chemists*, *druggists*, and *grocers*. It is more prevalent in the winter, probably owing to the greater liability of the hands to be chapped, thus allowing any irritants more ready access through the skin, denuded of some of its outer layers. The affection is due directly to handling dry drugs, etc., such as **iodoform**, **arnica**, **carbonate of soda**, **bleaching powder**, **soap**, and **sugar**. The condition is heralded by intense itching, followed by a papular or scaly eczematous rash on the backs of the hands and fingers, the palms generally remaining free. Vesicles appear, and when the crusts break, painful cracks and fissures are left on the backs and sides of the knuckles, with thickening of the skin.

The handling of **quinine** and a few other dry chemical powders causes very fine vesicles, and Thibierge<sup>1</sup> has likened the appearance of the skin thus induced to the rind of an orange.

Hall<sup>2</sup> describes a particularly distressing condition to which chemists are occasionally liable. This is a generalized rash, caused by the local application of **phenyl-hydrazine hydrochloride**, which spreads not by continuity or by hand. It affects the part or parts touched, and radiates without further contact to the face, scrotum, and thighs.

A case of this dermatitis is reported by Galloway,<sup>3</sup> in which

<sup>1</sup> Besnier, Brocq, et Jacquet, "La Pratique Dermatologique," 1901, tome ii., p. 436.

<sup>2</sup> *Brit. Journ. Derm.*, 1899, vol. xi., p. 112.

<sup>3</sup> Allbutt and Rolleston, "System of Medicine," 1911, vol. ix., p. 86.



the whole body was affected by a severe erythematous vesicating eruption with intense discomfort, pruritus, and considerable constitutional disturbance. The condition resulted from wearing some clothing on which a solution of phenylhydrazine hydrochloride had been spilled.

Oppenheim,<sup>1</sup> in discussing occupational diseases, states that men employed in making **cantharides plasters** and the **tincture** suffer from dermatitis.

**Cinchona Bark.**—According to Barres and Courtois-Suffit,<sup>2</sup> much irritation of the hands, forearms, and even of the face, has been caused by boiling cinchona bark, when used for making pharmaceutical preparations, and putting up sulphate of quinine into bottles.

The following details with regard to the former process are given by Chevalier:<sup>3</sup> When boiling cinchona bark, the *stirrers* are exposed to the irritating steam and fluid. They suffer from an intense itching and smarting of the arms, hands and face, followed by redness and œdematous swelling, upon which confluent vesicles form. These vesicles are remarkable for their varying and often large size. Upon breaking, the serum dries and forms crusts. The affection lasts from three days to three weeks; it was first described by Chevalier, and later by Bazin.

*Bakers, pastry-cooks, and confectioners* are frequently the victims of skin affections, the back of the hand being a common site of trouble, as the result of the constant kneading of the dough. This condition has been given the name of "baker's psoriasis," also "sugar-baker's itch," on account of the dry and scaly patches, of more or less circular shape, of the usual lesion.<sup>4</sup> This dermatitis does not occur in biscuit manufactories, and flour does not cause it.

<sup>1</sup> *Wien. klin. Wochens.*, 1914, Jahr. xxvii., p. 63.

<sup>2</sup> "Maladies Professionnelles," 1903, p. 104.

<sup>3</sup> *Annales de Méd. et d'Hygiène*, vol. xlviii.

<sup>4</sup> Besnier, Brocq, et Jacquet, "La Pratique Dermatologique," 1901, p. 448.



There appear to be many instances of a dermatitis associated more or less directly with **sugar**. Sequeira,<sup>1</sup> for example, states that *packing sweets* is a common cause of dermatitis.

Eczema is of so severe a character in the "sugar refineries" of Bromberg (Prussia), that if neglected it is liable to disable the workers for some considerable time.<sup>2</sup>

In Germany, purification of the juice is effected by "separation" and "saturation." In the former, 2 to 3 kilogrammes of fresh **quicklime** are added to 100 kilogrammes of beetroot, and the juice rendered alkaline.<sup>3</sup>

The dermatitis is of complex aspect; the continuous splashing of the boiling **beet-sugar** upon the exposed parts of the skin reaches any cuts and tears, and causes free exudation of serum. Secondary infection soon follows, and the lesions become pustular. The fingers and around the nails are principally affected, but the hands, forearms, legs and feet may also suffer.

Included under the heading of drysalter's itch may be mentioned also the eruption found amongst workers in the "fruit-preserving industry" in France.<sup>4</sup> When preserving **bitter oranges**, the essential oil which exudes from cutting the rind causes marked irritation. Imbert-Goubeyre states that, out of the forty-one workers he himself observed, only twelve were free from the affection. The lesions are restricted to the hands, especially the left hand in which the orange is held while cutting, the forearms and face, the oil being passed by the hands to the face. The condition begins with great smarting, and is quickly followed by general redness of the skin, which becomes swollen and œdematous. Numerous tiny

<sup>1</sup> "Diseases of the Skin," 1911, p. 77.

<sup>2</sup> Annual Report of German Factory Inspectors, 1903; quoted by Legge in Annual Report of H.M. Chief Inspector of Factories, 1905.

<sup>3</sup> Blücher, "Modern Industrial Chemistry," trans. by Millington, 1911, p. 659.

<sup>4</sup> *Moniteur des Hôpitaux*, 1894.





LIME DERMATITIS AND ONYCHORRHEXIS IN A PLASTERER.

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vesicles appear upon this, become confluent, and exuding, dry to form greyish-yellow crusts. Headache, dizziness, and cramp are occasionally observed, according to Barres and Courtois-Suffit.<sup>1</sup> This trouble is closely akin to the dermatoses venenata.

“Onychia.”<sup>2</sup>—The constant maceration of the hands in **syrups** when “preparing” and “crystallizing candied fruits” sets up redness and swelling of the finger-tips, with alterations in the nails. Ulcerations are reported to appear at the roots, and the nails are liable to fall, the second and third fingers being most usually affected.

Onychia is of fairly common occurrence in the “dried-fruit industry” of Southern France. It is a simple chronic inflammation of the borders of the nails, leading to purulent inflammation of the nail-bed. It begins as a superficial erosion of the skin around the nail, and is characterized by the absence of pain, and by its chronic course. Several fingers usually are affected, and the condition may persist for years, leading to permanent deformity of the finger and nails if neglected. Strauss<sup>3</sup> states that it is apt to be confused with other infective onychias, psoriasis, eczema, and even specific onychia of the nail. **Formalin** onychia<sup>4</sup> is recorded by Fisher and Galewsky.

*Plasterers, masons, and cement-workers* suffer from an eruption caused by splashing when **slaking lime**, and in “making Roman cement.” The abrasions resulting from handling angular particles of the material facilitate the entrance of the irritant. In the early stages of the acute eruptions, it is sometimes eczematous and oozing, later it becomes crusted; the chronic forms are the more usual, and are papular and lichenoid. In the case of plasterers, everything they handle is covered with fine powdered lime. Many workers apparently remain unaffected by this; but if from weakness, or when con-

<sup>1</sup> “Maladies Professionnelles,” 1903, p. 100.      <sup>2</sup> *Ibid.*, p. 108.

<sup>3</sup> *Deutsch. med. Wochens.*, 1912, vol. xxxviii., p. 2122.

<sup>4</sup> Thompson, W. Gilman, “The Occupational Diseases,” 1914, p. 595.



valescing after illness, the hands show any tendency to perspire, the rash rapidly makes its appearance. The hands feel dry, are stiff and swollen after work, and smart so much at night as to prevent sleep. The skin peels off in flakes, while the nails become friable, thin, and ribbed longitudinally. There is intense irritation at the forks of the fingers, and crusts appear on the sides of the knuckles; exudation is rare.

In some limestone districts skin-cracks may be of enormous extent on the feet of natives, who use neither boots nor shoes.<sup>1</sup>

### Carbide Ulcers.

Cases of dermatitis sometimes occur in the manufacture of **acetylene gas**. Professor Finger<sup>2</sup> of Vienna published an account of 12,000 cases of skin and venereal diseases, and amongst them that of a man who worked at an acetylene gas factory. Besides an eczematous aspect, he exhibited a number of sharply punched-out suppurating ulcers involving the whole thickness of the skin. These varied in size from that of a lentil to that of a sixpence.

The above description points to the possibility of **caustic lime** being the active ingredient. According to Blücher,<sup>3</sup> in the manufacture of **calcium carbide**,  $\text{CaC}_2$ , powdered charcoal or coke is heated with quicklime in an electric furnace. These substances require very thorough mixing, and the dust of the lime would easily account for the development of carbide ulcers.

Acetylene gas,  $\text{C}_2\text{H}_2$ , is evolved by the addition of water to carbide.

A dermatitis may also be caused by the use of **plaster of Paris**. Whitfield<sup>4</sup> records a case of onychorrhaxis occurring in a dentist using this substance.

<sup>1</sup> *Brit. Med. Journ.*, 1914, vol. i., p. 966.

<sup>2</sup> *Ibid.*, 1904, vol. i., p. 609 (Abs.).

<sup>3</sup> "Modern Industrial Chemistry," English trans., 1911, p. 136.

<sup>4</sup> *Lancet*, 1914, vol. i., p. 607.

### Mercury.

Legge<sup>1</sup> states that there is a dermatitis due to handling **fulminate of mercury**,  $\text{Hg}_2\text{CNO}$ , in the filling, packing, or cleaning of detonators in explosive factories. Drying and mixing the powder also cause trouble. The face and arms suffer chiefly. These cases are slight, as a rule. Dr. A. Josias<sup>2</sup> has published the report of similar conditions, a fact drawn attention to by Legge.

The latter describes the process as follows: The wet fulminate of mercury is spread out by hand on cloths placed on a hot table. One end of the cloth is then raised and the powder tilted to the other end. The fine dust disturbed by this proceeding falls upon the skin, and dermatitis follows. Employees new to the work are readily affected.<sup>3</sup>

Rambousek<sup>4</sup> draws attention to the corrosive action of **mercurous nitrate**. Blücher<sup>5</sup> says its effect upon the skin is to turn it a purplish red, which becomes black in the light. It is used for "carrotting"—that is, brushing a solution of this salt over rabbit-skins in the manufacture of felt hats—as well as for colouring horn, etching, painting on porcelain, and for putting a black bronze on brass art metal. In New York a number of cases of superficial ulceration of the fingers and arms are reported by Gilman Thompson.<sup>6</sup>

In the manufacture of **biniodide of mercury**, which is made from a solution of potassium iodide and perchloride of mercury, the precipitate is dried in a heated oven, crushed into powder by hand-rollers, and packed into jars. According to Collis,<sup>7</sup>

<sup>1</sup> Annual Reports of H.M. Chief Inspector of Factories, 1909, 1911, and 1914.

<sup>2</sup> "Maladies Professionnelles," 1903, p. 22.

<sup>3</sup> Annual Report of H.M. Chief Inspector of Factories, 1908.

<sup>4</sup> "Industrial Poisoning," 1913, p. 44.

<sup>5</sup> "Modern Industrial Chemistry," 1911, p. 413.

<sup>6</sup> *Academies of Medicine in Buffalo and Rochester*, April, 1913.

<sup>7</sup> Annual Report of H.M. Chief Inspector of Factories, 1911.

in addition to the mercurial intoxication to which it gives rise, rashes develop on the chest and back. In one case blisters formed on both forearms and feet, as well as on the left ring-finger.

### Phosphorus.

**Sesquisulphite of phosphorus** has sometimes been known to produce temporary erythema of the skin. According to Legge,<sup>1</sup> the eruption which may occur from making lucifer matches is of a pustular character. The most troublesome cases reported have been amongst the *dippers*—i.e., those who handle or lean over the paste—and not in the workers who *mix* the paste.

Legge<sup>2</sup> suggests further that the irritation may be due to the liberation of sulphuretted hydrogen.

### Thorium Dermatitis (Chronic).

According to Blücher,<sup>3</sup> gas-mantles are usually impregnated with a mixture consisting of 99 per cent. of **thorium nitrate**, 1 per cent. of cerium nitrate, and some ammonium nitrate.

A case of diffuse dermatitis was exhaustively described by A. Friedländer.<sup>4</sup> It appeared on the back of both hands, especially the right, and also in discrete clumps on the forearms, gradually increasing in intensity. The patient, a girl aged seventeen, had been working for two years in the impregnating-room of an incandescent gas manufactory, passing the mantles through a watery solution of thorium nitrate, in order to impregnate them with this substance. She did not suffer at all until the end of a year. Then intense redness and swelling appeared on the back of the thumb, forefingers, and hand, especially on the ulnar side and ball of the little finger. A similar condition was found in patches on the forearm. The

<sup>1</sup> Annual Report of H.M. Chief Inspector of Factories, 1908.

<sup>2</sup> *Ibid.*, 1910.

<sup>3</sup> "Modern Industrial Chemistry," 1911, p. 265.

<sup>4</sup> *Arch. f. Derm. u. Syph.*, 1912, vol. cxiii., p. 359.

nails were deeply embedded, owing to the volume of the swelling at the finger-tips. The skin of the palms of the hands appeared to be thrown into folds, divided by deep creases.

An illustration in three-colour photography shows the intense coloration and swelling of the tissues, the result of the œdematous infiltration of the epidermis. The back of the hand is liable to be early affected, from the fact that this part comes mainly into contact with the chemicals.



## CHAPTER IV

TRADES, CHEMICALS, AND PROCESSES—*Continued*

## Polishers.

*Polishers* are liable to different forms of dermatitis. Thus, men who have to use **rouge**, an oxide of iron, may be attacked by erythema of the hands. Dr. A. J. Hall<sup>1</sup> mentions a case of this description which lasted eleven years. According to Oliver,<sup>2</sup> **lime** and sand are employed for polishing brass and copper.

The **pyridine** and **methyl alcohol**, or **wood spirit**, used in denaturing alcohol, are said to cause some of the eczemas which arise in those working in methylated and other denatured alcohols.

Drs. Barres and Courtois-Suffit<sup>3</sup> quote the statement of Blaschko, who says *furniture polishers'* eczema is seldom of the moist variety. It attacks the forks of the fingers and knuckles most severely, and Blaschko believes that the **pyridine** used to denature the alcohol is partly responsible for the trouble.

In England,  $\frac{3}{8}$  per cent. of **mineral naphtha** is used to denature methylated spirit, and the addition of wood spirit in small quantities to alcohol is used to transform it into industrial spirit.

<sup>1</sup> *Lancet*, 1902, vol. i., p. 311.

<sup>2</sup> "Dangerous Trades," 1902, p. 454.

<sup>3</sup> "Maladies Professionnelles," Paris, 1903, p. 101.

**Turpentine** has a special action upon the skin, leaving the cuticle dry and liable to crack. The trouble affects the back of the hands and forearms particularly, but not the palms, where there are no sebaceous glands.

Collis<sup>1</sup> noted fourteen cases of dermatitis among the workers in engineering shops, their skin having been much irritated by the cooling and lubricating mixtures containing turpentine, and alkaline emulsions of mineral oil (*vide* p. 88). The disease failed to appear when neither turpentine nor mineral oil was used, and is probably largely due, as he states, to the **shale oil**. The addition of a small amount of a disinfecting fluid, such as creosote, does away with the irritation. Turpentine is used in "aerographing," "lubricating metal sheets," "printing," and for "mixing paints."

Collis has recorded eczematous eruptions, which have appeared after wiping down steel plates with a doubly refined Prussian turpentine, and using paints made with the same turpentine.

In lads cleaning cartridge-cases by this material in ammunition works, Legge came across this dermatitis. It took the form of a dry chronic eczema, "eczema rimosum," of the backs of the hands and on the arms.

Gebert<sup>2</sup> has seen papular and papulo-vesicular affections on the hands and forearms of *printers*, as the result of using impure turpentine. He describes the rash as similar to that caused by impure petroleum. Blaschko corroborates this statement, and has himself noted similar cases.

In "dry-polishing" silver jewellery the workers use a red powder which, according to Drs. Barres and Courtois-Suffit,<sup>3</sup> contains **mercury**. It produces a dermatitis of the forearms and backs of the hands. Lime is commonly employed by polishers to keep the surface dry.

<sup>1</sup> Annual Reports of H.M. Chief Inspector of Factories, 1910 and 1914.

<sup>2</sup> *Dermatologische Zeitschrift*, September, 1913, No. 9, vol. xx.

<sup>3</sup> "Maladies Professionnelles," 1903, p. 104.

### French Polishing.

In this trade the technical operations of "stripping," "filling in," and "staining," besides "polishing," are sources of trouble.

In "stripping"—that is, removing paint, grease, etc., or lightening stains on wood—strong solutions of **soda** are required; but a much more active stripping agent in common use is **oxalic acid**—3ss. to Oi. of industrial spirit. This solution is a strong irritant, and sets up inflammation at the roots of the nails, and makes the finger-tips tender and sore.

**Turpentine** is the chief component of patent fillers-in, which are bought ready made and used to fill in the pores and smooth the wood before polishing.

**Potassium bichromate** is used to stain woods and wooden floors. It darkens all kinds of wood, but is especially valuable for mahogany and oak, and Lucas<sup>1</sup> says the stain can be darkened by the addition of **Bismarck brown**.

**Chrome** ulcerations<sup>2</sup> were discovered in two *French polishers* who employed **bichromate of potassium** to stain mahogany. If a brush is used to apply the stain instead of a rag, the common method, little or no inconvenience follows. Linseed oil rubbed over the hands and arms prior to work wards off the trouble.

### Bronzing.

Collis<sup>3</sup> gives an account of the process used to transform articles of copper, etc., into so-called "art metal." They are placed in a watery solution of ammonium sulphide. Brass and steel are soaked in **arsenic** dissolved in **hydrochloric acid**. **Bronzing powder** contains an arsenical preparation, and, before using, this must be mixed with hydrochloric acid.

<sup>1</sup> "The Book of Receipts," 1907, p. 124.

<sup>2</sup> Annual Report of H.M. Chief Inspector of Factories, 1913.

<sup>3</sup> *Ibid.*, 1911.



The process employed is as follows: Free the metal from grease, paint, or dip in a dilute solution of ammonium hydro-sulphide, and allow to dry. Brush off any separated sulphur, then paint with a dilute ammoniacal solution of arsenic sulphide. In some cases **antimony sulphide** is substituted for arsenic.

Lucas<sup>1</sup> gives the following as an example of a bronzing material:

Fuchsin	...	...	...	...	10 parts.
Aniline purple	...	...	...	...	5 „
Alcohol, 95 per cent.	...	...	...	...	100 „
Benzoic acid	...	...	...	...	5 „

Geer<sup>2</sup> states that **chrysoidine** (di-amido-azo-benzene), a red-dish crystalline powder, is employed for lacquering tin. It is an aniline dye of rich orange colour.

**Benzine** is used for cleaning these articles, as well as for dissolving rubber. C. Vignolo-Lutati<sup>3</sup> specially describes two cases he saw in a rubber factory (*vide* p. 80).

### Electro-Plating.

**Metal-plating** is prodigal in the production of skin diseases. It is, however, difficult to separately apportion the blame, as the operations are numerous, and the chemical ingredients vary, according to the different metals.

It is highly necessary that all metals previous to plating should be absolutely free from both grease and soap.

Watt<sup>4</sup> gives the following description of the process of metal-plating:

A "hot potash bath" containing  $\frac{1}{2}$  pound of American **potash** to the gallon of water. Then follows either—

<sup>1</sup> "The Book of Receipts," 1907, p. 129.

<sup>2</sup> "Industrial Accidents and Diseases," 1909, p. 51.

<sup>3</sup> *Il Morgagni*, 1913, vol. lv., part 1, p. 271.

<sup>4</sup> Watt (Alex.), "Scientific Industries explained," Edinburgh, 1881.



The "cyanide dip" containing **cyanide of potash**  $\frac{1}{2}$  pound to the gallon, for brass or copper; or the hydrochloride dip, consisting of 1 part of **acid** to 5 parts of water for iron and steel. This last process is technically called "pickling."

The object plated is now "scoured" in the scouring-tray by a hard brush and powdered pumice-stone.

Then placed in the "nickel vat," containing a watery solution of pure crystals of the double **sulphate of nickel**, and **ammonia** 1 pound to the gallon.

The metal requiring plating is often "polished" by the aid of chalk previous to the above processes, and also after plating.

Rambousek<sup>1</sup> has described the eczematous inflammation of the skin, which occurs in **nickel-plating** establishments, as it affects the hands and arms, and occasionally the whole body. The skin becomes inflamed, and vesicles appear on the irritated part. Some persons are extraordinarily susceptible to this disease, whereas others only become so after having worked for years without any indication of trouble. Some are, however, then compelled to abandon this occupation. The disease is most probably caused by the action of nickel salts, especially **nickel sulphate** in the electrolytic baths. As a matter of fact, several writers have traced the disease to contact with the **benzine**, **petroleum**, and **lime** used by the workmen. **Strong soda** solutions, when used for cleaning the metals, may cause deep ulcerations and fissures of the skin of the hands.

Barres and Courtois-Suffit<sup>2</sup> state that in some works the strong alkaline baths precede the benzine baths, so important is it to remove all traces of grease and soap. The nickelling solution may consist of pure **zinc chloride** and **nickel sulphate**.

<sup>1</sup> "Industrial Poisoning," 1913, pp. 96, 186, and 197.

<sup>2</sup> "Maladies Professionnelles," 1903, p. 102.

In these vats **chlorine** in a nascent state and hydrochloric acid are liberated, and, combined with the lime on the men's hands, must set up much irritation, besides disorders of sensation in the hands.

The operation of "scratch-brushing" where spoons, forks, other silver or gold articles, and jewellery, are cleaned by a revolving brush upon which **sour beer**, instead of the usual soap and water, is continually falling, causes an eczematous condition of the hands, forearms, and face. Hall<sup>1</sup> describes a similar irritation, set up by the **quick rouge** powder, used in the process of polishing and burnishing silver and electroplated goods. A similar condition is also referred to by Drs. Barres and Courtois-Suffit.<sup>2</sup>

**Rouge** consists of ferric oxide and, as used in this trade, it sometimes contains 2·7, 1·8 to 0·4 per cent. of **mercury**.

In an annotation of the Sheffield Medical and Chirurgical Society's Meeting,<sup>3</sup> Hall<sup>4</sup> states that *finishers* in electroplating works also suffer from a dermatitis caused entirely by **lime**. He describes the case of an elderly worker, who had been a finisher all his life, and handled a mixture of finely powdered quick-lime, with sufficient oil to form a soft adhesive paste in contact with the revolving plate he was polishing. Dermatitis and fissures followed, these developed into ulcers, and gradually increased in size. When adequate protection against the lime was resorted to, the wounds soon healed.

A final burnish is given to most nickel-plated steel articles such as bits and spurs, by the use of powdered quick-lime on the rotating calico mops.

In many of the above processes rubber gloves are a necessary protection.

<sup>1</sup> *Brit. Journ. Derm.*, 1902, vol. xiv., p. 121.

<sup>2</sup> "Maladies Professionnelles," 1903, p. 102.

<sup>3</sup> *Lancet*, April 20, 1901.

<sup>4</sup> *Brit. Journ. Derm.*, 1901, vol. xiii., p. 209.

### Photographer's Dermatitis.

Few *photographers* escape entirely from the disagreeable and occasionally invaliding effects of some of the solutions in common use when developing plates and paper. These solutions are strongly alkaline and, to susceptible skins, this alone is enough to cause irritation. In the writer's experience, it is chiefly one hand which suffers, owing to its being more frequently immersed in the bath—namely, the one nearest the ruby lamp.

**Pyrogallie acid** is the oldest, and probably the best, substance to use, but its tendency to stain is objectionable. Photographers say they often use it for years without any ill-effects, and cannot understand why it should have recently induced a dermatitis. The explanation is not quite clear, but it may be due to the fact that repeated small doses of the noxious drug have gradually induced an anaphylactic condition in the operator. This is a state in which the very smallest quantities of the drug rubbed into the skin will, in a very few hours (twelve to twenty-four), produce a marked reaction (Jadassohn's test).<sup>1</sup>

In the slight cases of dermatitis there is irritation and smarting, especially round the nails and between the fingers, with numerous painful cracks appearing in the creases.

The derivatives of pyrogallie acid are extensively used; thus an acute dermatitis is described by A. B. Northcote as occasionally affecting the fingers which had touched, or been immersed in, a solution of "**Metol** (gr. xiv.) and **Hydroquinone** (ʒi.) developer," in combination with sulphite of sodium ʒi., carbonate of soda ʒii., ad ʒxx. of the solution. The fingers tingled, smarted, and were swollen with an urticarial rash.<sup>2</sup>

Metol is Monomethyl-p-amido-m-cresolsulphate. It some-

<sup>1</sup> Semon, *Brit. Med. Journ.*, 1913, vol. ii., p. 904.

<sup>2</sup> *Lancet*, 1904, vol. ii., p. 1751.



times induces an erythematous condition which, commencing in the hands, spreads to the forearms.

**Amidol** is used as a developer, about gr. cxx. to the pint, combined with the ordinary quantity of carbonate and sulphite of soda. After prolonged exposure to the solution, troublesome itching and pruritus are occasioned, which extend to the arms, chest, and rest of the body. Pruritus is intense, and the skin feels hot. As this subsides, general desquamation follows. In a case quoted by Dr. Arthur Storrs,<sup>1</sup> six weeks elapsed before the soles of the feet peeled.

The same active agents are employed in developing "stereotype plates," the alkalies consisting of carbonate of potash and bisulphite of soda, the reducing agents being pyrogallic acid, amido-phenol, para-amido-phenol, and metol. The eruptions caused by these drugs are always found upon the hands, but by accidental contact they may also spread to the face and scrotum.

**Bichromate** poisoning has been described amongst Edinburgh photographers, and cases have been reported in which a bichromate developer had been used in the process of "carbon printing."<sup>2</sup>

**Carbon Photography.**—The gelatine used in this method is mixed with pigment of any colour, and the paper carrying this film is sensitized by floating in a solution of **potassium bichromate**. Upon exposure under a negative the gelatine, in the portions exposed to the light, becomes insoluble and retains the pigment; whilst the portion protected by the darker shades of the negative is almost unacted upon, and may be dissolved out by warm water. Contact of this chromated gelatine with the reduced silver of an ordinary

<sup>1</sup> *Brit. Med. Journ.*, 1904, vol. ii., p. 1751.

<sup>2</sup> Burns, Annual Report of H.M. Chief Inspector of Factories, 1913; and Legge, article on "Potassium and Bichromate," in Oliver's "Dangerous Trades," 1907, p. 447.



bromide print has a similar effect, and hence may be copied by squeezing into contact with sensitized pigmented gelatine.<sup>1</sup>

Seider<sup>2</sup> showed a case before the Vienna Dermatological Society, in which corrosive ulcers had appeared on the back of the patient's right index-finger subsequent to washing away the copies on tin plates with **caustic soda** in a photographic tracing establishment.

These caustic soda ulcers are similar to those caused by strong acids, being deep-seated, usually circular, lentil to farthing-sized, with sharply defined edges. (*Vide* Seider's case under "Acids," p. 33.)

In France, the use of **chromic** and **phosphoric acids** in etching zinc plates has been a source of serious trouble.<sup>3</sup>

**Bichromate of Ammonium** is used as a sensitizing solution when preparing plates for etching in the "photo-engraving" and "printing" industry. The photographers suffer who print on metal with this salt and fish-glue.<sup>4</sup> In the "etching-room" the *printers* are subject to dryness of the skin, or an eczematous or pustular eruption on the hands and arms. This trouble is seen more or less in the majority of those employed, and relapses are of frequent occurrence.

### Arsenic.

The method by which **arsenic** is now obtained is to heat cobalt and arsenical pyrites,  $\text{Fe}(\text{SAs})_2$ , in earthen pipes or jugs attached to receivers in which the sublimed arsenic condenses.

According to Rambousek,<sup>5</sup> **white arsenic**,  $\text{As}_2\text{O}_3$ , arsenious acid anhydrate, or simply arsenious acid, is obtained by roast-

<sup>1</sup> Thorpe, "A Dictionary of Applied Chemistry," 1913.

<sup>2</sup> Seider, "Transactions of Vienna Dermatological Society," January 18, 1911. *Arch. f. Derm. u. Syph.*, 1911, vol. cvii., p. 439.

<sup>3</sup> Rambousek, "Industrial Poisoning," 1913, p. 58.

<sup>4</sup> Rauchmorrow and Tolhurst, Report of Departmental Committee on Compensation for Industrial Diseases, 1907, § 8943 *et seq.*

<sup>5</sup> "Industrial Poisoning," 1913, pp. 143, 144.

ing with excess of air in reverberatory furnaces the arsenical ores, and smelting the residues. The white arsenic sublimes and settles on the walls of the prepared channels and chambers.

Those engaged in the *roasting, extracting, and packing* of arsenic are very liable to diseases of the skin. Further, the presence of arsenic must be taken into account in the “smelting” of other arsenical ores, such as tin, nickel, lead, copper, iron, and silver.

Here, the dangers are chiefly due to the presence of the fine arsenical powder pervading the atmosphere, settling upon the unprotected skin. The powder penetrates beneath the clothes and, mixing with and dissolving in the secretions of the body, causes intense irritation, especially of the thighs, scrotum, and feet.

The workers engaged in the handling and manufacture of the oxide and soluble salts soon begin to show the effects of slight arsenical poisoning. As a first result, the workers have a tendency to develop an artificial stoutness, but afterwards, owing to being continuously exposed to the dust and fumes, they become pale and emaciated, and finally develop skin rashes and sores, especially in the armpits, genitals, and wherever the skin creases hold the dust. The men most affected are those employed in the “still-room,” making **arsenic acid**, and who handle the kegs of white arsenic, the *pan-men* and *furnace-men* who evaporate the solutions, and calcine the finished **arsenate of soda** to a fused mass. The latter soon become incapacitated, owing to the constant breathing of dust and arsenic fumes.

Arsenic comes into use in “paper-staining,” as arsenite of chromium, arsenite of copper, and aceto-arsenate of copper—all green pigments.

Arsenious oxide,  $\text{As}_2\text{O}_3$ , is employed in “calico-printing” dissolved in glycerine as a reducing agent.

**Bin-arsenate** of soda,  $\text{NaH}_2\text{AsO}_4$ , and **arsenate** of soda,  $\text{Na}_2\text{HAsO}_4$ , also find use in "calico-printing" as fixing or clearing agents, and are known as "dung salt" or dung substitute. The solution affects the hands, pulping the skin cuticle, owing to its slightly alkaline condition. Arsenic solutions of the mordant type, being alkaline, are not suitable for wool-dyeing.

Dermatitis was of frequent occurrence in the manufacture of **fuchsin**, a sulphur dye made from arsenic acid, one of the triphenylmethane group, all of which contain arsenic. Stockings dyed with fuchsin have caused copious rashes, and marine blue gloves are recorded as having produced dermatitis. The use of soluble arsenical compounds as dyeing agents has been practically replaced by aniline colours. In Germany, Sweden, and Norway, it is forbidden to employ arsenical compounds for dyeing wearing apparel or domestic objects.<sup>1</sup>

Formerly a common source of danger was to be found in drying, grinding, and stirring the boiling solutions of emerald green, so-called **Schweinfurter**—aceto-arsenite of copper. It is a mixture of arsenious acid, potash, and acetate of copper. Besides having a strong local irritant action, it is exceedingly poisonous.

Cases of dermatitis due to compounds of arsenic were described long ago, amongst others by Chevalier,<sup>2</sup> Follin,<sup>3</sup> Imbert-Goubeyre,<sup>4</sup> Vernois<sup>5</sup> and Rollet.<sup>6</sup>

Other trade purposes for which these compounds are employed, together with a record of its resultant effects, are as follows :

**Arsenious acid** is still utilized for preserving sheep-skins imported from Buenos Ayres and Monte Video. When unhair-

<sup>1</sup> *Lancet*, 1879, vol. i., p. 856.

<sup>3</sup> *Arch. de Méd.*, 1857.

<sup>5</sup> *Ann. d'Hygiène*, 1859.

<sup>2</sup> *Ann. d'Hygiène*, 1847.

<sup>4</sup> *Moniteur des Hôpitaux*, 1857.

<sup>6</sup> *Annales de Derm.*, 1880.



ing the skins in this country, the arsenic may give rise to trouble. A usual arsenical paste for curing skin is :<sup>1</sup>

R Potassium carbonate	...	...	...	12 parts.
Arsenious oxide, soft soap, and slaked lime			āā	4 „
Powdered camphor and black pepper	...		āā	$\frac{3}{4}$ part.

A mixture of **arsenic sulphide** and **lime** is used in tanneries for “unhairing.” Legge<sup>2</sup> says **caustic potash** is added in some cases to the solution of arsenious acid.

Again, in the preservation of skins and furs and stuffing of animals white arsenic is used.

The Inspector of East London, in 1905, referred to the severe dermatitis of the face, neck and hands, from which men suffered who were engaged in packing the light powder sent out from the works for sheep-dipping purposes.

Arsenic is used for colouring chalk. Rambousek<sup>3</sup> states that the preparations held to be noxious are white arsenic (arsenic trioxide), arsenic acid, copper arsenite, and arsenic chloride.

White arsenic<sup>4</sup> is much used for preserving corpses, for the treatment of hair used for making hats, and in glass-making.

In 1900 Legge<sup>5</sup> reported examples of dermatitis in the manufacture of **arsenical emerald green**, aceto-arsenite of copper. Out of twenty-five women engaged in “packing the powder” into small tins, he found sixteen suffered from eczema of the face, and one showed an ulcer on the septum nasi. “Drying” and “grinding” this colour give rise to the most trouble.

Later, Legge<sup>6</sup> stated that much diffusion of the powder

<sup>1</sup> Lucas, “The Book of Receipts,” 1907, p. 152.

<sup>2</sup> Annual Report of H.M. Chief Inspector of Factories, 1902.

<sup>3</sup> “Industrial Poisoning,” 1913, p. 145.

<sup>4</sup> Blücher, “Modern Industrial Chemistry,” 1911, p. 71.

<sup>5</sup> Annual Report of H.M. Chief Inspector of Factories, 1900.

<sup>6</sup> *Ibid.*, 1902.



also takes place when the arsenite of copper is emptied into a hopper; from this the dry, light powder is transferred into small tins.

In 1910,<sup>1</sup> he reported six further cases of eczematous ulceration occurring from the manufacture of this green.

Sheep-dip is an **arsenite of soda** containing arsenic sulphide, and free arsenious acid. The processes of "grinding" and "packing" cause considerable dust, and this may lead to perforation of the septum.<sup>2</sup>

The rash induced by this powder is characteristically seen round the eyes, temples, neck, chest and armpits.

White<sup>3</sup> records a case in which an eruption of firm, red-pointed, isolated vesicles and excoriated papules appeared on the face, neck, hands and forearm of a farmer after syringing a tree with **arsenate of lead**.

**Arsenite of copper** (Scheele's green) is also used as an insecticide for fruit-trees.

In 1907 Legge,<sup>4</sup> writing again on this subject, recorded three cases of arsenical dermatitis occurring in the manufacture of emerald green—one in making arsenical green paint, one from making sheep-dip, and one from unloading white arsenic. The symptoms consisted of conjunctivitis and eczematous ulcerations.

Collis<sup>5</sup> states that sores in the groin are of common occurrence in the manufacture of emerald green.

Legge,<sup>6</sup> again, in 1911, mentioned three cases of ulceration in workers in white arsenic manufactories, four in the manufacture of emerald green, and one in preparing sheep-dip powder. In manufacturing sheep-dip, it is when "moving" and "packing" the powder that danger is to be mainly anticipated.

<sup>1</sup> Annual Report of H.M. Chief Inspector of Factories, 1910.

<sup>2</sup> *Ibid.*, 1902.

<sup>3</sup> Transactions of the American Dermatological Association, forty-fifth year, p. 1027.

<sup>4</sup> Report of H.M. Chief Inspector of Factories, 1907.

<sup>5</sup> *Ibid.*, 1908.

<sup>6</sup> *Ibid.*, 1911.

In this trade pigmentation of the skin is a marked feature.<sup>1</sup>

The chronic dermatitis caused by arsenic is characterized by boils and pimples. These are found on any of the exposed parts of the body, but more especially affect the bends of the limbs, where it is prone to lodge, and under the clothing the genitals suffer most.

When associated with steam, or in strong solutions, arsenic causes the skin to assume a diffuse redness, upon which papules and vesicles quickly form; these rapidly change into pustules, which dry into thin yellow-greenish crusts. If exposure at this point is discontinued, resolution will occur. Should the irritant action be continued, however, the pustules develop into ulcerations. In the very chronic cases clean cut out ulcers, with a greyish slightly moist base, with markedly indurated bases and edges, appear at the points where the skin is broken.

Arsenic is a protoplasmic irritant leading to keratosis, which condition, if subject to trauma or irritation, is liable to take on epithelial hyperplasia and malignant degeneration.

### Bichromates.

Legge<sup>2</sup> says that in the manufacture of the bichromates the potassium and calcium chromates are heated in the furnace. The batch, when withdrawn, is cooled by pouring water upon it. Much steam is evolved, partly due to the slacking of the **quicklime**, and many particles of the bichromate salts are carried into the air with the steam. When cool, the batch is broken up, thus causing further dust.

The salts are crystallized out in the evaporating pans, then dried, broken, weighed, and packed. During these processes the workmen come into contact with the steam issuing from

<sup>1</sup> H.M. Chief Inspector of Factories, 1914.

<sup>2</sup> Oliver, "Dangerous Trades," 1902, p. 447.

the boiling fluid, together with the hot solutions, or the dried dust. Common causes of dermatitis are to be found in the stirring of the fluid in the "keaves," and the work in the crystal-house.

**Chromic acid** ( $\text{Cr}_2\text{O}_3$ ) is a powerful oxidizing agent, and is largely used for that purpose in many highly technical processes. It is strongly corrosive to the skin, especially in the nascent state, which is usually generated by the addition of some acid to the bichromate solution. The acid **dichromates** contain a large proportion of chromic acid, and for that reason are much used in different industries.<sup>1</sup>

Many of the salts of chromium, such as the chromates and oxides, are neutral, and their harmful action is chiefly mechanical. According to Blücher,<sup>2</sup> potassium and sodium bichromate have a caustic action, due largely to their content of free acid; the specific action of these salts on the skin is fostered by heat, moisture, the previous removal of the cuticle by injury, or the action of strong alkalies.

The fine dust of the **bichromates** has an irritating effect upon a skin denuded of its horny layers, or upon such delicate structures as the mucous membranes.

Chrome sores are of frequent occurrence amongst the employees of the following industries:

In bichromate and chromate works.

Amongst chrome *tanners*. In the manufacture of chrome **pigments**, all of which are made from potassium bichromate. *Painters*, when using chrome **colours**. These include the following: Chrome green,  $\text{Cr}_2\text{O}_3$ , also called green cinnabar, oil green, leaf green; chrome orange or chrome yellow,  $\text{PbCrO}_4$ , known under

<sup>1</sup> R. Fischer, "Die industrielle Herstellung und Verwendung der Chromverbindungen." Polytechnische Buchhandlung. A. Seydel, Berlin, 1911.

<sup>2</sup> "Modern Industrial Chemistry," 1911, p. 542.



various names, such as lemon royal, Leipzig, Cologne and Paris yellow, or lead yellow. Both of these colours cause dermatitis. Otto Sachs<sup>1</sup> mentions two painters who worked with these colours mixed with turpentine. Both men developed turpentine dermatitis, and in addition a papulo-verrucous rash.

*Wool-dyers*, especially when using chrome as a mordant to fix the colours.

In cotton-dyeing and printing, where chrome salts are used as "oxidizers," and "discharging" agents.

In "aniline-black dyeing," where chrome is used as an oxidizing agent, and, with the black, forms chrome lake.

In the manufacture of certain "safety matches" in Sweden. The paste used consists of 3 to 6 per cent. of chrome salt. Rambousek<sup>2</sup> calculates that each match-head will contain about  $\frac{1}{2}$  milligramme. Severe attacks have been noted, and Wodtke found in eighty-four workers early perforation of the septum of the nose.

The bichromates combined with sulphuric acid are used as oxidizing agents in making "coal-tar colours," such as anthracene into alizarine, and aniline violet.

They are also used for bleaching oil, tallow, and fat.

They are employed in photography, especially in the "carbon process."

The mucous membrane of the nose is frequently attacked, and cases are quoted by Legge,<sup>3</sup> in which other mucous membranes, such as the tonsils, palate, and larynx, have shown chromic ulceration.

F. Hermann<sup>4</sup> says all workers in free chromium and the

<sup>1</sup> *Wien. klin. Wochensch.*, No. 45, 1911. "Epitome," *Brit. Med. Journ.*, 1912, vol. i., p. 60.

<sup>2</sup> "Industrial Poisoning," 1913, p. 52.

<sup>3</sup> Oliver, "Dangerous Trades," 1902, p. 447.

<sup>4</sup> *Münch. med. Wochensch.*, 1901, vol. xlviii., p. 231.



chromates suffer after a time, unless the precautionary regulations are strictly enforced.

Chrome sores are generally found at the roots of the nails, the creases of the knuckles, and the skin between the fingers. The web between the thumb and first finger is particularly susceptible. Previous laceration of the skin, however, generally determines the site of the sore, which may also be found on the wrist or arm.

A chrome sore begins as a papule, which is constantly being thrown off by the friction of the work. The wound gradually deepens and widens, until it may extend into the derma. The chrome hole is indolent, conical in shape, with a rounded, thickened edge. The trophic nerve-endings are slowly destroyed. The sensory nerves seem to be numbed, as little discomfort is felt by the victims and work is not interrupted. When away from their work, the men say these sores give rise to a considerable amount of smarting and pain, especially at night, probably due to the undisturbed growth of pyogenic organisms. Cases have been recorded in which loss of the nails, and deformity of the joints resulted from chrome sores.<sup>1</sup> They may even extend down to the bone. Their usual size varies from that of a hemp-seed to that of a bean.

The duration of a chrome sore, if not very deep, is about three weeks, presupposing that the sufferer abandons work, and is no longer in contact with the material. Should he, on the other hand, ignore the trouble and continue his employment, it will last indefinitely. Chrome holes are essentially a chronic condition, their onset being slow and insidious, and recovery equally tardy.

The following ointment is recommended by Collis as a preventative to be rubbed on to the hands prior to work:

R Mineral lard	...	...	...	...	3 lbs.
Paraffin mollis	...	...	...	...	6 ozs.
Cylin	...	...	...	...	3 „

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<sup>1</sup> *Lancet*, 1905, vol. ii., p. 1635.





**ACUTE DIFFUSE CHROME DERMATITIS.**

Caused by exposure to the steam and liquid arising from a vat he was stirring, containing a boiling solution of bichromate of soda, in the stocking dyeing industry.

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**Chrome-dyed stuffs** are occasionally responsible for dermatitis.

“A delicate man handling cotton velvet, used as an upholstering material, developed an eruption of rounded or oval elevated purplish-red patches, with some slight scaling on both forearms. This spread gradually to the face, body, and lower extremities, and lasted at least two months, until cured by abstention from his occupation. The material was examined by Dr. W. H. Wynn, pathologist to the Birmingham General Hospital, and was found to contain bichromate of potassium, alumina, with a salt of iron.”

In the writer's opinion, the presence of bichromate of potassium in such cases is due to imperfect washing after dyeing.

### Acute Chromium Dermatitis.

The condensation of steam, from the **boiling bichromate solutions** containing particles of the salt, acts powerfully upon the skin, causing an acute and severe dermatitis. This is the result of the particles being carried with the issuing steam and falling upon the unclothed parts, such as the face, neck, and arms. During the boiling process, drops of the liquor containing bichromate have been measured to reach a foot and a half above the level of the boiling fluid. This fact was proved by Heise and is quoted by Legge.<sup>1</sup> A similar condition was also reported by the author.<sup>2</sup> The eruption in these cases is a diffuse erythematous rash, beginning as a scaly papule, with a red spreading areola, quickly becoming confluent. If the case is severe, serum and sero-pus exude, particularly at the flexures of the skin. Pain and irritation are comparatively mild for so acute a condition, as is usual in all local lesions caused by chrome compounds. This is a somewhat uncommon but definite form of chrome

<sup>1</sup> Oliver, “Dangerous Trades,” 1902, p. 447.

<sup>2</sup> *Lancet*, 1910, vol. i., p. 297.



dermatitis, and distinct from the chronic variety. It is readily cured by the avoidance of further exposure, together with soothing treatment.

The fine **powder** of the acid chrome salts may settle upon any parts of the skin and, if supplemented by heat, friction-sweat, or moisture, will at any time set up a similar erythemato-papulo-vesicular eruption, though there are but few cases recorded.

### Skin-Dressers and Tanners.

The process of "skin-dressing" and "tanning" consists in treating the hides with tanning material in such a way that they are converted into leather—that is to say, are rendered soft and pliable.

The hides of cattle, calves, horses, deer, etc., are all used in the preparation of leather, and have to be subjected to a series of processes before the actual tanning takes place. Tannin is a mordant as well as a tanning agent for leather.

In the "tawing" process some of the skins are covered with a creamy mixture of **lime** and water by hand. The fleecing is finished by plucking out with tweezers and rubbing down with a whetstone. The liming is repeated several times. Further parts of the work are the bran, alum, and salt baths. Fats and other agents are also used previous to rubbing, rolling, and finishing.

The hides are immersed in pits containing lime, water, and **caustic alkalies**, the last of which enhance the effect. They are frequently turned in the milky fluid, and are then washed and scraped by the fleshing-knife. The "raising process" follows. This consists in soaking the hides in a very weak solution of sulphuric acid, or of lactic, acetic, or formic acid. They are then placed in the tanning pits.

In **chrome tanning** the yellow and orange-coloured salts, chromate and bichromate of sodium, are used with common

salt and, when absorbed by the fibres of the hide, are reduced to a green compound by **hyposulphite of soda** or other strong reducing agent.

Collis<sup>1</sup> states that the hides are picked out of the **acid chrome** vats by hand, and placed upon wooden horses to drain. They are then stretched by machines. In the next bath the reducing agent fixes the chrome, and renders it harmless to the skin of the hands of the workers.

In manufacturing chrome-tanned glacé kid<sup>2</sup> from goats'-skins the following operations take place: Liming and **arsenicating**, puring or baiting in dog manure to neutralize the lime, dipping in the bichromate solution—twenty-four hours' immersion in hyposulphite of soda—dyeing in logwood, staking to stretch the skins, and have the roughness removed by mechanically-moving heavy wooden jaws, seasoning—*i.e.*, smearing with aniline colour mixed with carbolic and oxalic acid—and polishing by wooden machinery.

Chrome tanning<sup>3</sup> is effected by two methods, both of which originated in America, the "one-bath process," or the "two-bath process." In the former, the hides are treated with basic **chromium sulphate** and **chromium oxychloride**. In the latter, the goods are first steeped in a solution of  $K_2Cr_2O_7$  (bichromate of potassium), or  $Na_2Cr_2O_7$  acidified with  $HCl$ . In the second bath, the chromate is reduced to the chromous state usually by a solution of sodium thiosulphate, to which  $HCl$  is added. Afterwards the tannage is fixed by treatment with solutions of lead acetate, barium chloride, or soap. The leather is finally washed, dried, stretched, and greased by dipping it into a warm benzine solution of paraffin.

Amongst leather tanners, by the one-bath method, chrome sores are not found to affect the neutral bath-workers. Sores appear, however, after using the acid bichromates in the

<sup>1</sup> Annual Report of H.M. Chief Inspector of Factories, 1911.

<sup>2</sup> *Ibid.*, 1910.

<sup>3</sup> Blücher, "Modern Industrial Chemistry," 1911, p. 429.

two-bath process,<sup>1</sup> resulting from the liberation of nascent **chromic acid**, by the addition of sulphuric acid to the bath.

Legge<sup>2</sup> observed six cases of chrome ulceration in a tannery, where the bichromate was squeezed out of the skin with a special tool.

Blücher<sup>3</sup> says that only salts of chromic oxide have any tanning effect on the hide, and of these the basic oxides are the most effective. Salts of chromic acid must, on the contrary, be reduced to chromous compounds.

Chrome in this industry is used neither as a mordanting, nor as an oxidizing agent.

The characteristic lesions on the skin are observed chiefly amongst hide-dressers and tanners, and are due to the effects of lime and the preparations of chrome. The lesions produced by the lime are occasionally remarkably like chrome ulcerations. These were described amongst tanners many years before the new chrome process was known. Amongst leather-dressers **arsenic** was formerly possibly responsible for some of the lesions. Brocq named the early typical bright red spot surrounded by a white zone, which characterizes the chrome sore, "le pigeonneau." The punched-out ulcer is seen later.

### Olive-Oil Dermatitis.

In the processes of rolling and making tobacco, when certain varieties of tobacco are being spun into a rope, from which originates the name "twist," the leaf is lubricated by continuously dropping **oil** upon it. As is well known to dermatologists, prolonged contact with olive oil will exercise a noxious influence upon the skin. It is also irritant to the conjunctiva. The baneful effects induced by this oil in this trade are fully

<sup>1</sup> *Department of Labour Bulletin*, September, 1913, p. 405, State of New York.

<sup>2</sup> Annual Report of H.M. Chief Inspector of Factories, 1901.

<sup>3</sup> "Modern Industrial Chemistry," 1911, p. 429.



described by Collis<sup>1</sup> in certain branches of the tobacco industry.

He found twenty-two cases of dermatitis in the "twisting" process, and five cases in "turning off" or "rolling," during which the rope of tobacco is oiled by hand, and the skin becomes freely saturated. Oil is used to prevent the ropes of tobacco from adhering, when they are being pressed. Black twist, again, is wrapped in oiled paper, or cloth. The black twist workers are the only ones affected. Olive oil is solely used in these processes. In a private communication Dr. Collis states that the oil was of the best obtainable quality, clean, and fresh. The proportion necessary for the manufacture is 2 per cent.

The dermatitis is described as being restricted chiefly to the dorsal aspect of the left hand, when the drip method of oiling is used, which chiefly falls upon these parts. In the *spinner's* assistants the under surface of the wrists are affected. Altogether Dr. Collis records eighty-seven cases. The process does not appear to give rise to folliculitis.

<sup>1</sup> Annual Reports of H.M. Chief Inspector of Factories, 1909 and 1910.



## CHAPTER V

THE PETROLEUM AND COAL DISTILLATES AND  
RESIDUES

## Liquid Hydrocarbon Manufactures.

IN all instances in which raw **petroleum** is handled the workers suffer, whether it be at the mines, refineries, pumps, or in the manipulation of the raw petroleum itself.

A careful classification of the special forms of dermopathy, to which different workers are liable, has been compiled by Drs. Barres and Courtois-Suffit,<sup>1</sup> and runs as follows:

Workers in **paraffin** suffer from pustules and ulcerations.

Workers in **tar** suffer from acne and furuncles.

Workers in **resin** suffer from vesicular and pustular eruptions.

These authors particularly describe the papillomata arising from cleaning out the vats containing the residual products after the last distillation of liquid petroleum. They also mention the similarity between this disease and chimney-sweeper's cancer, as seen by Messrs. Derville and Guermont in 1890 and 1892.

From 1890 to 1893 eighteen cases of **petroleum** acne were reported in French refineries; eleven of these occurred at the paraffin presses, five from cleaning out the still residues, and two were in persons who were occupied in filling the vessels.

<sup>1</sup> "Maladies Professionnelles," 1903, p. 105.

In the **naphtha industry** skin affections are found in those working amongst unpurified oils. Eruptions are seen on the skin as the result of "pressing out" the paraffin, and practically all the workers of three refineries in the district of Czernowitz (Austria) were affected. Ogston refers to the warty growths from which those suffer who have to *clean* out the stills.<sup>1</sup>

In the official statistics, which include 1,380 petroleum-workers in Russia, nine were reported to be suffering from general symptoms, and forty-three from petroleum acne.

Opinion is unanimous, as to the injurious action of mineral oil on the skin, and particularly to the fact that the graver consequences are produced by the petroleum residues.<sup>2</sup> The resultant products of the distillation of petroleum and coal would appear to agree with regard to this.

### Petroleum.

The type of local injury to the skin seen amongst petroleum-workers varies greatly. In a general review of the effects upon the skin of petroleum and tar, their distillates and residues, one is almost forced to agree with the views of Ross and Cropper, that the irritant, whatever it may be, is the same or similar in all these products. If we accept this, variety in the clinical picture will then chiefly depend upon the concentration of the irritant, and such factors as constant or occasional exposure, temperature, consistency of the material, whether in a fluid state or in powder, etc.

An attempt at classification appears desirable, if it is only a very rough summary of the different grades of the effects observed on the skin. Though it may not pretend to the wished-for accuracy, it is helpful in elucidating a complicated subject.

The crude oil, whether of the paraffin or the naphtha

<sup>1</sup> Rambousek, "Industrial Poisoning," 1913, p. 64.

<sup>2</sup> *Ibid.*, p. 61.

series, is split up into three fractions by a single distillation : (a) **benzine**, or petrol naphtha (boiling-point  $150^{\circ}$  C. and under) ; (b) **lighting oil** (boiling-point  $150^{\circ}$  to  $300^{\circ}$  C. and under) ; (c) **residuum** (boiling-point above  $300^{\circ}$  C.). These distillates and residues are further redistilled and purified to obtain the various petroleum ethers, oils, and the semi-solids and solids, such as vaseline and paraffin.<sup>1</sup>

Speaking generally, the different distillates cause varying grades of dermatitis, roughly corresponding to the temperatures at which they are given off :

1. Superficial inflammation of the skin, with dry, scaly conditions, or eczematous lesions showing fine vesicles, pimples and pustules.
2. Papular and pustular eczema, miliary folliculitis, with or without perifolliculitis (acne), and abscesses.
3. Erythema, keratosis senilis — punctiform folliculitis, warts, ulcers, and carcinomata.

These appearances are not necessarily sequential the one upon the other, and mixed lesions prevail amongst the workers, especially in the distillates coming off at the higher temperatures.

The dermatitis caused by **volatile hydrocarbons** of the petroleum series is usually of a diffuse and superficial nature. Benzine, or petrol naphtha, is used in the manufacture of rubber. Two cases of dermatitis due to benzine are described by C. Vignolo-Lutati.<sup>2</sup> The patients, two young men, both had their hands continuously wetted with a solution of india-rubber in **benzine**. The only parts affected were the interdigital clefts of the second, third, and fourth fingers, over areas corresponding to the contact of one finger with another. The lesions first showed themselves by itching and redness,

<sup>1</sup> Rambousek, "Industrial Poisoning," 1913, p. 59.

<sup>2</sup> *Il Morgagni*, 1913, vol. lv., part i., p. 271 (leaderette). *Brit. Med. Journ.*, 1913, vol. ii.



followed by swelling, a month after the commencement of this work. In the second case, small miliary, reddened vesicles developed, some of them being intact, others broken and displaying a macerated floor with a few shallow cracks. When the hands were closed, if the fingers were in apposition, the appearance of the palm and dorsum was quite normal. A number of men engaged in the same employment had previously been compelled to relinquish it owing to the discomfort it caused.

Benzine and **carbon disulphide**<sup>1</sup> have similar actions upon the skin. The former is used for the purpose of extracting fat in bone-works, the latter in vulcanizing. Perrin considers the effects are due to the withdrawal of heat, and partly to the solvent action on the natural grease. The skin is reddened, contracts, and feels dry and unpleasant.

A like effect upon the skin called for inquiry by **amyl-acetate** and **amyl-acetone**.<sup>2</sup> The name "Zapon" is given to celluloid dissolved in these fluids. It appears to be used in rooms where cold lacquering is done. Similar compounds are used for impregnating linen to render it waterproof, and also in the manufacture of artificial leathers.

The following appear to be examples of the *second* grade—the so-called petroleum eczema. They are described by Dr. Wood<sup>3</sup> as intractable weeping eczemas occurring in workers in a ropery in the process of *drawing-in*. In his cases the hemp "sliver" was being constantly oiled by **Pumpherson oil**, which continually bathed the hands and bare arms of the girls who were pressing down the sliver into the cans.

A female *brushmaker*, aged seventeen, had a symmetrical eruption of two years' duration on the extensor surfaces of both forearms; itching was moderate. The lesions consisted of a horny plugging of the hair follicles, with inflammatory

<sup>1</sup> Rambosek, "Industrial Poisoning," 1913, p. 71.

<sup>2</sup> Legge, Annual Report of H.M. Chief Inspector of Factories, 1913.

<sup>3</sup> Annual Report of H.M. Chief Inspector of Factories, 1911.



thickening round them, and indolent pustules in some instances. The patient's arms were constantly being splashed with oil from the brush-making machine.

An aberrant form showing vesicles has been described by Rambousek and others.

Blaschko<sup>1</sup> describes a typical case. The patient worked in a garage at cleaning the cars, and suffered from a papular and papulo-vesicular affection of the hands and forearms. This was attributed to the impure petroleum he was compelled to use. Blaschko regards this case as a trade dermatitis.

Petroleum eczema is seen in fire-brick or cement factories amongst those removing the bricks from the moulds on which petroleum oil has been dropped. A pustular rash may form on the inner surface of the hands, necessitating absence from work. Dr. Legge<sup>2</sup> reported an example at some brick-works. The eczematous eruption affected the arms, thighs, and legs of some of the workmen, due to the oil soaking into the clothes and spreading over the skin.

The view taken is that this condition is largely due to the poor class of oil used, and to insufficient care in washing. This latter point is supported by the report of the Factory Inspector at Rouen,<sup>3</sup> who found that marked diminution of this affection followed greater attention to this matter.

### Petroleum Acne.

#### BOUTON D'HUILE—FOLLICULITIS AND PERIFOLLICULITIS OF SPINNERS.

This condition was first drawn attention to by Leloir in 1889. In describing it,<sup>4</sup> he says that "it is seated in the hair follicles; these become dilated and filled with broken hairs

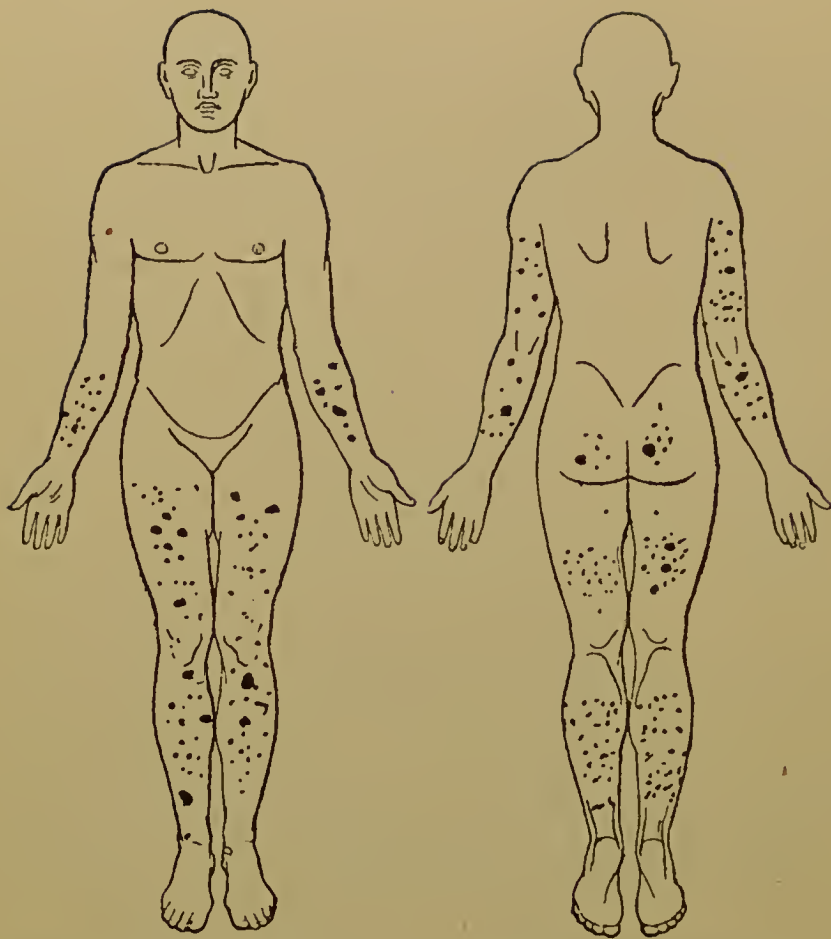
<sup>1</sup> *Derm. Zeitsch.*, September, 1913, vol. xx., No. 9, p. 811.

<sup>2</sup> Annual Report of H.M. Chief Inspector of Factories, 1912.

<sup>3</sup> Rambousek, "Industrial Poisoning," 1913, p. 203.

<sup>4</sup> *Annales de Derm. et de Syph.*, March, 1885, and September, 1889.





SKETCH OF DISTRIBUTION OF OIL ACNE IN A CAN-BREAKER  
IN A COTTON MILL.

AUTHOR'S SERIES.

*To face page*

and horny cells mixed with dirt and oil, which sets up a perifolliculitis. The corium round the follicle becomes infiltrated with round cells, the vessels dilate, and some of the tissues necrose. Eventually the whole follicle may be discharged."

Lefebvre<sup>1</sup> contributed a thesis on the same subject in 1888.

These lesions are of fairly common occurrence, and are liable to arise wherever dirty oil from the joints and gearing of machinery constantly comes in contact with the skin. In spinning mills this may be effected directly by the fine spraying of the oil from the spindles revolving in the oil-cups, or indirectly from saturated skirts, sleeves, trousers, or cleaning-rags. In former days the oil-cups of spinning spindles were much shallower than they are at present, and the oil was showered in a fine spray some feet away. These cups are now made much deeper, and the result is both economical and cleanly. The chief sufferers are *slubbers*, *rovers*, and *scavengers*, but *spinners* and *doffers* are commonly affected by the disease; carders and workers at the opening and willow machines more rarely. The condition is observed in the cotton, woollen, and flax industries.

The rash, which is markedly symmetrical, may be confined to the upper or lower limbs, although occasionally it is found on other parts of the body. Large, indolent boils develop, especially on the extremities, in debilitated subjects. The distribution is further characterized by the fact that the feet, hands, and backs of the knees remain free.

The condition is easily recognized by the stippled ground of minute black dilated follicles, upon which the typical rounded, well-raised, hard papules of a dusky red colour are irregularly dotted. These vary in size from that of a hemp-seed to a split pea, and are centred by a hair. They may become surrounded by a zone of erythema, or develop into an acute boil. Usually, however, they are indolent lesions which

<sup>1</sup> *Annales de Derm. et de Syph.*, 1888, p. 824.



form slowly, take many weeks to recede, and leave a pitted scar behind.

A paper giving an account of "Acneform Eruption in Flax Doffers in Belfast" was read by Dr. H. S. Purdon in 1902.<sup>1</sup>

A similar condition has been reported by Warde as occurring in *stokers* of engines, *gas-fitters*, and others whose duty it is to carry cans of lubricating oil, which is liable to become spilled over the clothes.<sup>2</sup>

The *third grade* consistently shows the fine punctiform folliculitis, which is also sometimes seen in the previous group. This has been described by Neugebauer and others as occurring in men who labour amongst the distillates which come off at high temperatures, and in the residues found in the petroleum stills. This folliculitis is not very noticeable by artificial light; it appears chiefly on the exposed parts of the body, but may be more general. There is little evidence of inflammation. This condition is accompanied by the brownish-yellow tint of the skin known as "pitch skin."<sup>3</sup>

In this grade one commonly sees a verrucose tendency, due to acanthosis and epidermic proliferation. The strongest predisposing cause is probably a degenerative change, as shown in the "senile skin" of paraffin-workers, depicted below by Dr. Bolam.<sup>4</sup> He states that he has three or four cases similar to one described by Dr. Adamson as "keratosis senilis," and by Unna as "sailor's skin." Keratosis senilis differs from **rodent ulcer**, in that the former arises always on a damaged skin. This keratosis assumes sometimes a squamous, and sometimes a basal-celled, type of epithelioma.

Dr. W. Walker<sup>5</sup> says **shale-oil-workers** are peculiarly liable to suffer from paraffin cancer. The initial lesion may be

<sup>1</sup> *Brit. Med. Journ.*, 1902, vol. ii., p. 752.

<sup>2</sup> *Brit. Journ. Derm.*, 1900, vol. xii., p. 212.

<sup>3</sup> *Wien. klin. Wochensch.*, 1914, vol. xxvii., p. 39.

<sup>4</sup> *Brit. Journ. Derm.*, 1913, vol. xxv., p. 260.

<sup>5</sup> Annual Report of H.M. Chief Inspector of Factories, 1913.

either an erythema, a papule, or a pimple. This dries up, forming a hard crust and, as it increases in size becomes a hard, elevated, wart-like mass, leaving a sloughing ulcer, or ending in paraffin cancer. He mentions two cases requiring complete excision, and one on the back of the wrist necessitating amputation at the shoulder.

From information given by Mr. Brown in this report, it appears to be the **scale** which causes the eruption on the arms of the workers. Scale is the residue remaining when all the intermediate and lubricating oils have been removed, and is finally converted into wax. The men become contaminated when shovelling this scale mixed with oil on to the cloths going to the hydraulic presses, and later, when emptying by hand the cloths containing the pressed scale into the melting-pots. The arms are bare to the shoulders during these processes.

Numerous illustrations of paraffin carcinoma were exhibited by Drs. Norman Walker, Cranston Lowe, and others, in the Museum of the Dermatological Section of the Seventeenth International Congress of Medicine, London, 1913.

#### PARAFFIN LITERATURE.

BELLAD : Paraffin Epithelioma of Scrotum. *Edin. Med. Journ.*, 1878, vol. ccliv.

DERVILLE and GUERMONPREZ : The Papilloma of Paraffin Refiners. *Journ. des Sciences Médicale de Lille*, 1892, vol. iv.

LIEBE, P. : A Case of Paraffin Cancer. Ref. in Schmidt's *Jahrbücher*, 1892, p. 325.

KIRK : Paraffin Cancer. *Brit. Med. Journ.*, 1903, vol ii., p. 1528.

ULLMANN, K. : Demonstration of a Case of Multiple Paraffin Carcinoma of Scrotum. Vienna Dermatological Society, November 3, 1909, with discussion.

#### Chlor-Acne.

This condition is here treated separately from pitch dermatitis, to which it undoubtedly belongs, in deference to common usage. The type of lesion and its authentic appearance, only

when associated with the presence of coal derivatives, hardly warrant this disunion.

In March, 1897, Bettmann<sup>1</sup> showed two patients at the Heidelberg Medical Clinic suffering from "chlor-acne." Their skins were diffusely pigmented dark grey, and were noticeably rough and dry. Further, there was the distinct acne associated with tar.

The workmen were employed in cleaning out an acid tower used in the making of hydrochloric acid. Later, twenty-one cases developed similar symptoms in men engaged in the identical work—viz., clearing out the inside walls by taking out the lining, and putting it back into the tower. Other cases were mentioned. There was no free **chlorine** in this chamber when cleaned. Loose derivatives of **tar** were, however, present, and the vessels in which the hydrochloric vapours were developed were all tarred over for protective purposes.

Thibierge and Pagnier<sup>2</sup> describe the rash as a folliculitis, showing a projecting rounded papule, with a vesicle at the apex, and a black plug. The lesions are remarkably numerous, almost all the sebaceous glands being affected. The face and head appear as if tattooed with a charge of gunpowder exploded close to the skin. The eruption is very abundant round the ears. The body and limbs are less involved, but the penis and scrotum show sebaceous enlargements. The face is generally red and swollen.

When discussing this subject, Drs. Barres and Courtois-Suffit<sup>3</sup> draw particular attention to the similarity of the lesions, known as chlorine acne, to those caused by many varieties of tar.

<sup>1</sup> *Deutsch. med. Wochensch.*, No. 27, 1901, p. 437. *Vide* also Herxheimer, "On Chlorine Acne," *Münch. Med. Wochensch.*, 1899. Brandt and Herxheimer, "On Chlorine Acne," Transactions of the Twelfth Congress of the German Dermatological Society.

<sup>2</sup> "L'Acne Chlorique," *Annales de Derm.*, July, 1900, p. 815.

<sup>3</sup> "Maladies Professionnelles," 1903, p. 101.



Rambousek<sup>1</sup> says that "cases of chlorine rash, formerly of constant appearance in a factory for the electrolytic manufacture of chlorine, disappeared entirely on substituting magnetite at the anode for carbon.

The carbon anodes, according to Blücher,<sup>2</sup> are made from tar cement. It must be remembered that the containing vessels are tarred over in electrolytic works.

Rambousek<sup>3</sup> states that in a factory for the production of "salt cake," this was dried on an endless band, which was tarred over. The tar adhered to the salt cake, as well as to the earthenware trays handled by the workmen, who became affected with the rash. Contact with these trays, on which the tar had become condensed, was recognized as the cause of the dermatitis. Danger was avoided by getting the workers to observe the most scrupulous cleanliness. It was found that when the mixture of salt cake and tar was hot the affection became much more prevalent.

Lehmann and Roth both suggest that the rash is not due to external irritation, but is caused by absorption and elimination of chlorine by the glands.

Legge<sup>4</sup> considers the chlorine element in **chloride of lime** and **dinitrochlorbenzene** may cause the skin eruptions, and ulcerations that occur from working with these substances. The armpits, and other parts of the body liable to sweat, are apt to be affected.

Legge records sixteen cases occurring in the manufacture of dinitrochlorbenzene, showing dermatitis of the face, armpits, feet, etc. He says, in the operations of crystallizing, crushing, and packing dinitrochlorbenzene a large amount of fine floury dust is raised. It settles on the hands, temples, forehead, and hair, and imparts to them all a bright canary-yellow colouring. No blood changes were found.

<sup>1</sup> "Industrial Poisoning," 1913, p. 173.

<sup>2</sup> "Modern Industrial Chemistry," 1911, p. 167.

<sup>3</sup> "Industrial Poisoning," 1913, p. 173.

<sup>4</sup> Report of H.M. Chief Inspector of Factories, 1910.



A dermatitis has been reported to be caused by dinitrochlorbenzole,<sup>1</sup> used in the manufacture of certain dyestuffs. It begins with a burning and smarting sensation, which is often intolerable. The condition is exacerbated by the presence of water or grease. It causes erythema, with much oedema, affecting the hands, face and neck, by contact, and is supposed to be due to the presence of chlorine in the compound. Bernstein<sup>2</sup> recorded nine cases.

The writer of this manual has never seen this condition, despite a large acquaintance with men handling dinitrobenzene and dinitrochlorbenzene.

### Coal Distillates.

The cases of trade dermatitis seen in special **coal** industries are many and varied. As with the petroleum series, so in the tar series, roughly speaking, the type of eruption caused by a distillate or residue varies with the temperature at which the former comes off. **Pitch** and **tar** are the most interesting from the dermatologist's point of view. **Petroleum oils**, like the **heavy tar oils**, are made water-soluble by adding crude **resin oil**, and saponifying by **alkalies**. Tool machines are largely greased by this composition, which will set up a superficial cytitis.

Drs. Barres and Courtois-Suffit<sup>3</sup> describe the papillomata they found in navvies whose duty it was to **creosote** the sleepers on railway lines. Black plugs appeared in the obstructed follicles on the back of the hands and fingers, some of which apparently resembled warts the size of peas. On the scrotum these warts were as large as chestnuts, soft to the touch, covered by a hardened crust, painful on pressure, and without induration at their base. On detaching the crust, the surface was found to be red and bleeding; these

<sup>1</sup> *Lancet*, 1912, vol. i., p. 1534.

<sup>2</sup> *Lancet*, June 8, 1912, vol. i., p. 1534.

<sup>3</sup> "Maladies Professionnelles," 1903, p. 103.

sores were apt to degenerate into epithelioma. There was enlargement of the glands in Scarpa's triangle.

A case of "sleeper-creosoting dermatitis" is reported by Mackenzie.<sup>1</sup> It is also found amongst *colliers*, from handling the creosoted props used in timbering the places where they work.

Dr. Legge has described a like condition in brickworks where creosote oil was used for lubricating the moulds. In the case of an elderly man, the irritation thus induced was so severe that it assumed an epitheliomatous character, necessitating operative measures. This is the only known case of such marked severity due to this particular oil. Mr. Taylor<sup>2</sup> reports two severe cases of skin disease in a creosoting factory.

The quality of the oils used appears to have much to do with bringing about the condition, the heavier and less refined having the most noticeable effect.

Creosote oil<sup>3</sup> is the fraction passing over in the distillation of coal-tar between 250° and 280° C. It is employed in the crude state, as an illuminant, as a fuel, for the preparation of lamp-black, for preserving timber, and for the preparation of creolin, lysol, and other disinfectants.

Its composition is complicated, as it contains **cresylic acid**, **pyrol**, **pyridine**, and traces of **phenyls**.

Raw **anthracene**, the highest boiling fraction in coal-tar distillation, is used commercially, under the name of **carbolineum**, as a paint for preserving wood. It is distilled from coal at 300° to 400° C., and the workers suffer from severe skin affections. Rambousek<sup>4</sup> says these sometimes develop into cancer.

J. F. Schamberg<sup>5</sup> informs us that men are affected who

<sup>1</sup> *Brit. Journ. Derm.*, 1898, vol. x., p. 417.

<sup>2</sup> Annual Report of H.M. Chief Inspector of Factories, 1913.

<sup>3</sup> Blücher, "Modern Industrial Chemistry," 1911, p. 211.

<sup>4</sup> "Industrial Poisoning," 1913, p. 107.

<sup>5</sup> *Journ. of Cutaneous Diseases*, December, 1910. Current Literature. *Brit. Journ. Derm.*, May, 1911 (Abs.).

draw paper saturated with **tar** through rollers. In this process the hands and arms get thoroughly smeared with coal-tar. The men remove this from their arms and hands by using a heavy oil. Four workers are described as showing evidence of cancer. Tar induces a keratosis of the hair-follicles, which become plugged with blackheads. Sometimes keratotic discs are seen. The follicles inflame, leading to pustules. The hands, arms, and scrotum are especially involved. Carcinomatous changes are most usual about the fifth decade of life. The trend of these lesions is towards slow involution or destruction of the follicles by ulceration, which Dr. Brook<sup>1</sup> says is the almost invariable rule in this and similar pitch troubles.

Schamberg discusses the possibility of coal-tar possessing radio-active properties.

Ehrmann<sup>2</sup> states that **peat**-workers suffer from multiple warts on the skin. Sometimes these appear as common warts; in others they look like condylomata accuminata. Crops of these small white papillomata are present on the nose, chin, the region of the beard, and round the nasal orifices.

Other crude tar-workers include makers of **plastic cement**, those employed in tarring roads, preparing roofing-paper and felt with preparations of tar, as well as certain kinds of brattice cloth. There are no authentic reports of workers in these occupations who have suffered from this trade dermatitis.

It is, however, Legge says, the manufacture and use of certain varieties of **pitch** which has given the name to this special form of dermatitis and caused some trades so evil a reputation. The *mixers*, *heaters*, and *pressers* of briquettes are most severely affected.

<sup>1</sup> Report of the Departmental Committee on Compensation for Industrial Diseases, 1907, par. 7804 *et seq.*

<sup>2</sup> *Monatsch. f. prakt. Derm.*, 1909, vol. xlviii., p. 898.



According to Legge<sup>1</sup> and Blücher,<sup>2</sup> coal-pitch is used for making **briquettes**, various **lacquers**, **asphalt**, and **mineral pitch**.

In the manufacture of **patent fuel**, in making **coal-oil** into **grease**, and in **cork-stone** works, pitch is used. Cork-stone is made from finely divided cork mixed with a mineral cementing material. This artificial stone is impregnated with molten pitch under pressure *in vacuo*. According to Blücher,<sup>3</sup> it is fire-proof, non-conducting, and the lightest material used in building.

*Pitch-breakers*, and the men who heat and press briquettes, are peculiarly liable to suffer from pitch-skin and warts on the genitals. They exhibit many scars on their faces, the backs of their hands, and other exposed parts, the results of old ulcerations which have healed, imparting a honeycombed look to the skin. *Grinders* in the pitch-mills are particularly liable to be affected, and few are free from old or recent lesions. The typical so-called wart begins as a nodule, which breaks down and ulcerates; the crusts slowly formed then dry and harden. These sores, by reason of their chronicity and induration, suggest the appearances of warts. The edges of the ulcer are slightly raised and thickened, thus in many cases superficially resembling a rodent ulcer.

Ehrmann<sup>4</sup> gives a full description of the pitchy skin idiopathic to all this work. He particularizes the workers in **cork-stone**, **coke**, and **anthracite**, as well as the *dischargers* and *loaders* of pitch. The victim is distinguished by his swarthy appearance; his skin resembles that of an Indian, with yellow discoloration of the sclerotic. This secondary tint is a true pigmentation, resulting from persistent hyperæmia produced by the pitch fumes and dust. Whitfield<sup>5</sup>

<sup>1</sup> Annual Report of H.M. Chief Inspector of Factories, 1911.

<sup>2</sup> "Modern Industrial Chemistry," 1911, p. 524.

<sup>3</sup> *Ibid.*, 1911, p. 207.

<sup>4</sup> *Monatsch. f. prakt. Derm.*, 1909, vol. xlviii., p. 18.

<sup>5</sup> "Encyclopædia Medica," 1899, vol. ii., p. 273.



says that "if the pigmented skin is examined by a lens, the hyperæmia is shown to be a series of slightly red, thickened spots, due to dilated blood-vessels." These spots are not inflammatory, and may last for years. The earliest effect of tar and pitch fumes and dust, according to Galloway,<sup>1</sup> is erythema, sometimes intense. If exposure is prolonged or recurrent, secondary changes take place. Comedones are seen on the face, neck, back, and chest. The palmar surfaces of the hands are affected with keratosis, the right hand especially.

The follicles either suppurate or grow to a considerable size by slow proliferation. If numerous and agglomerated, they form the so-called tar mollusca. True papillomata grow from these, and, as stated previously under "Tar," they are usually multiple and benign, and show infiltration of leucocytes from unknown reasons. From the follicles a lateral outgrowth of epithelial cells develops beneath the surrounding epidermis, with a hard base and pearly edge. Should ulceration occur, a cribriform scar results. In exceptional circumstances the cells take on malignant growth. Whitfield<sup>2</sup> says that, independently of these lesions, the ordinary common flat wart is usually present, and may become malignant.

Irritation of the skin is not caused by **blast-furnace pitch** when used in the manufacture of briquettes.

The chemical differences between pitch from blast furnaces and **gas** works depend partly upon the nature of the coal used—"hard Scotch coal in the former, and chiefly bituminous coal in the latter"—and partly on the much lower temperature at which distillation takes place in blast furnaces, in comparison with the high temperature used in gas retorts.<sup>3</sup>

Drs. Ross and J. W. Cropper<sup>4</sup> found that marked cell-

<sup>1</sup> Allbutt and Rolleston, "System of Medicine," 1911, vol. ix., p. 88.

<sup>2</sup> "Encyclopædia Medica," 1899, vol. ii., p. 273.

<sup>3</sup> *Brit. Med. Journ.*, 1911, vol. ii., p. 884.

<sup>4</sup> "The Problem of the Gasworks Pitch Industries and Cancer." The J. H. McFadden Researches, 1913.

production, called by them the "auxetic reaction," was caused by certain substances. Most of them are amino-bodies. Gasworks tar, pitch, and soot contain auxetics, but not these substances obtained from blast furnaces. Further, these auxetics can be washed by water out of gasworks pitch, tar, and soot. Dr. Ross finds that in washing gas-tar, the binding principle is at the same time removed with the auxetics. These authors experimentally produced tumours in animals with the watery extracts of gasworks tar and pitch. They consider that in briquette-making the irritation is not caused by the dust, but by some soluble constituent of the tar. They say that the mischievous ingredient in pitch from coal does not lie in the anthracene oil itself, but is due to an impurity in the rough anthracene cake, probably arising from some special forms of vegetable life present in the Carboniferous Period.

Ross concludes that the dangerous principles are contained in the heavy coal-tar oils. He says these principles are neither anthracene nor anthracene oil, but probably substances mixed with them, which distil over at the same temperature. **Acridine** is not the cause of the trouble. Though Ross found auxetics and kinetic properties in bituminous samples of coal, in no cases were they present to the extent found in pitch and tar.

Auxetics contain **amidines**, **amines**, and **amido-acids**, which set up cell-division, usually benign, but the cells may become malignant. Pitch contains a higher concentration of these substances than tar, and tar than coal.

After working amongst pitch-dust, much pain and irritation are complained of by the men, when they wash or expose the skin to the air.

Ulceration, and rarely epithelioma, of the cornea have resulted from pitch getting into the eye. Conjunctivitis is of frequent occurrence.

According to Pusey,<sup>1</sup> **soot**<sup>2</sup> produces a similar condition to

<sup>1</sup> "Principles and Practice of Dermatology," 1907, p. 881.

<sup>2</sup> Soot contains much arsenic. E. S. Reynolds, *Med. Chronicle*, December, 1914, p. 157.

pitch cancer, though neither in soot nor in liquid petroleum have Ross and Cropper detected auxetics.

After careful research, Whitfield<sup>1</sup> found that the small flat warts mentioned, under "pitch cancer," were very numerous on the ulnar borders of the flexor surfaces of both forearms, in one of his cases of scrotal soot cancer.

A few years ago, the Registrar-General's return showed that "chimney-sweeper's cancer" was eight times more common than cancer in the general public. According to Pusey, this form of trade carcinoma, strange to say, is seen almost exclusively in England.

Rambousek<sup>2</sup> states that in making **lamp-black** the workers, who tread down the soot in receptacles, suffer from inflammatory eczema, and occasionally from epithelioma of the lower extremities, especially the toes. Lamp-black is made by the imperfect combustion of tar or tar-oil. This is effected by allowing these to drop upon heated plates of iron, with as limited a supply of air as possible. The burnt gases, laden with carbon particles, are drawn through several chambers or sacks, in which the soot collects.

Preventative measures are required in all these trades, with the purpose of arresting the leakage of any dust or fumes from the heated ingredients in the machinery, flues, or chambers in the different mechanical processes and devices. It is also necessary that the men's clothes and skin should be protected by overalls and suitable covering. Any cutaneous surfaces that have become soiled should be cleansed as soon as possible. To assist in this, some bland, insoluble ointment has been advised to be rubbed into the exposed surfaces prior to work. The quantity used should not be large, but enough to block up the stomata of the skin. A special point to be remembered is that all employees, particularly those over thirty-five years of age, should be regularly seen by a

<sup>1</sup> "Encyclopædia Medica," 1899, vol. ii., p. 473.

<sup>2</sup> "Industrial Poisoning," 1913, pp. 97 and 102.



medical man, so that any tendency to malignancy would be promptly detected and treated.

The origin, prophylaxis, and treatment of this dermatitis are receiving close attention by the British Factory Department.<sup>1</sup>

Two methods are on trial to render the auxetics in tar and pitch inactive—the “formaldehyde” and the “oxidation.” Both are satisfactory experimentally, and it is hoped that one or the other will prove commercially successful, so as to make work in these occupations reasonably harmless.<sup>2</sup>

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<sup>1</sup> Second Report of H.M. Secretary of State, Home Department, on the Draught Regulations proposed to be made for the Manufacture of Patent Fuel (Briquettes) with the Addition of Pitch. By Alfred H. Lush, 1913.

<sup>2</sup> D. Norris, *Biochemical Journal*, 1914, vol. viii., No. 3, p. 253.



## CHAPTER VI

## ANILINE DYES AND DYEING

WHEN endeavouring to apportion any irritating effects observed during the manufacture of **aniline dyes**, one must take into account the presence of strong **acids** and **alkalies**, particularly **lime**, during the process of converting the benzene, zylol, naphthalene, etc. It is thought that extensive erythema of the face, neck, and arms is caused by aniline vapours derived from the distillation of benzene in hot solution. It must be remembered that this vapour consists of a mixture of aniline and benzene, and the latter has probably a strong local noxious action.

According to Weil,<sup>1</sup> "the aniline and **azo** dyes are neither toxic nor irritant in themselves, but they may inaugurate irritation if soiled with some of the substances used in their production."

Sachs considers that the majority of these dyes can be administered, *per os*, without any toxic effect.

The aniline dyeing industry has for a long time been reputed to exercise an injurious action upon the skin. It is, however, more than probable that the other agents used with the dyes are the offending ingredients. At the same time, it is known that serious constitutional symptoms, or even death, may occur, when aniline is inhaled as vapour or absorbed by the skin. A case of acute aniline-poisoning

<sup>1</sup> *Archiv f. Derm. u. Syph.*, 1913, vol. cxvi., p. 556.

resulting in death was recorded by the author and Dr. Sellers at the Brussels International Congress of Occupational Diseases, 1910.<sup>1</sup> It is open to grave doubt, whether aniline can produce inflammation of the skin when topically applied; any local irritation caused is probably very slight.

Aniline and the azo dyes are usually supplied to the trade in powder or paste diluted with dextrine, Glauber's salt, or sodium biborate, to standards of tinctorial value. In dye-works known to the author, where one ton of aniline dyes in powder is used per week, there has not been a single case of dermatitis noticed in the colour-house amongst any of the *handlers* of the powder for many years.

These colours are employed by *painters*, *paperers*, and *varnishers*, and Blaschko<sup>2</sup> is strongly of opinion that the various **oils**, **turpentine**, **spirits**, **lime**, **gums**, or **dextrines**, mixed with the dyes are responsible for the trouble.

Some years ago, it was a common occurrence to have complaints of dermatitis, which had been presumably set up by the dye in the patient's clothing. The following case is recorded by J. C. White, and quoted by Jamieson:<sup>3</sup> "A number of men were provided with uniforms, each of them being given a new black cotton shirt. Many of the men suffered from a red infiltrated erythema on those parts of the skin with which the shirts came in contact. Neither **anti-mony**, **chrome**, nor **arsenic** were found in the clothing after analysis."

The mordant, or fixing agent, used in cloth is very frequently either arsenic or chrome. Dermatitis is probably due in some cases to the imperfect washing out of these substances. Another point to be borne in mind is that, after

<sup>1</sup> "Acute Case of Aniline-Poisoning, with Experimental Investigation into its Pathology." By Drs. Prosser White and Sellers. International Congress of Occupational Diseases, Brussels, 1910.

<sup>2</sup> *Arch. f. Derm. u. Syph.*, 1913, vol. cxvi., p. 556.

<sup>3</sup> *Boston Medical Journal*, 1897, vol. i., p. 78.

dyeing, some of the chemicals used in the final stages of cotton-shirting-finishing may cause irritation. These are commonly the **chlorides** of **calcium**, **magnesium**, and **zinc**. Their object is to give a feeling of fullness, softness, and mellowness to cheap flannelettes and cotton blankets. These salts are removed by the first washing.

Rambousek<sup>1</sup> states that **naphthalene** causes skin trouble, but the writer has been unable to obtain any records.

Men occupied in converting  $\beta$ -naphthol into **para red** suffer from swelling of the eyelids and mucous membrane of the nose. The first  $\beta$ -naphthol bath is strongly caustic and alkaline; the finishing bath is strongly acid. **Para red** is a skin pigment; **paranitraniline red** is produced on the fibre by diazotization with the addition of  $\beta$ -naphthol. It forms an insoluble colour. According to Legge,<sup>2</sup> **paranitraniline red** powder acts mainly on the blood, causing hæmolysis of the blood-cells.

Recorded instances of dermatitis due to **picric acid** are rare, though Rambousek<sup>3</sup> says it exhibits a strong action on some skins, and sets up an erythema resembling scarlet fever or measles.

Legge<sup>4</sup> reported four cases of dermatitis occurring in the manufacture of **picric acid**.

Blücher<sup>5</sup> says that **picric acid** is poisonous. Apropos of this the following statement is of interest: A manager of the largest works in this country remarked, "that during the last twenty years he was unacquainted with a single case of poisoning, and with the exception of an occasional burn, from the splashing of the **nitric acid** used in its manufacture, no case of irritation of the skin had been reported, either in the packing or handling of the acid in any of the departments."

<sup>1</sup> "Industrial Poisoning," 1913, p. 208.

<sup>2</sup> Annual Report of H.M. Chief Inspector of Factories, 1910.

<sup>3</sup> "Industrial Poisoning," trans. by Legge, 1913, p. 214.

<sup>4</sup> Annual Report of H.M. Chief Inspector of Factories, 1910.

<sup>5</sup> "Modern Industrial Chemistry," 1911, p. 520.



**Paraphenylene diamine**, a basic dye,  $C_6H_4(NH_2)$ , "produces skin eruptions," according to Rambousek.<sup>1</sup>

In the cotton-dyeing industry it is used in alkaline solutions in **coupling blacks**. This alkalinity must be borne in mind. This dye is the active agent for various brown hair dyes, though unsuitable for this purpose on account of its poisonous nature.<sup>2</sup>

Legge<sup>3</sup> says that **chrysoidin** (diamido-azo-benzene) and **Bismarck brown** (triamido-azo-benzene), also known under the names phenylene brown and vesuvine, will both of them set up skin troubles. At the present time they are principally used for staining leather, and are becoming of less and less importance in the dyeing industry. Both are basic dyes, and both are strongly acid and irritating.

**Azo-tri-phenyl-methane**,  $HC(C_6H_5)(C_6H_5)$ , an acid green dye, is stated by Otto Sachs<sup>4</sup> to have caused papilloma-like excrescences on the face and arms of a *painter* who had been working with it for nine months. A woman, who had used wools dyed with aniline colours, suffered from a similar eruption on the back of the hands and fingers. It seems hardly likely that either of these cases, showing such a highly specialized skin disease, was due solely to the aniline dye.

**Aurantia**, emperor's yellow, is a yellow aniline basic azo-dye (hexa-nitro-phenylamine) used for colouring cheap shoes and other goods yellow. It causes an abundant uniform-sized crop of vesicles thickly crowded together all over the palm, but without any arrangement. Cases were recorded by Radcliffe Crocker.<sup>5</sup> The use of this substance is prohibited in Germany, and it is not used on either silk or wool in this country.

<sup>1</sup> "Industrial Poisoning," 1913, p. 118.

<sup>2</sup> Blücher, "Modern Industrial Chemistry," 1911, pp. 118 and 215.

<sup>3</sup> Annual Report of H.M. Chief Inspector of Factories, 1910.

<sup>4</sup> *Wien. klin. Wochensh.*, 1911, vol. xxvi. (Abs.); *Brit. Med. Journ.*, Epitome 1912, vol. i., p. 60.

<sup>5</sup> *Lancet*, 1903, vol. i., p. 491.



Rambousek<sup>1</sup> mentions that work amongst aniline dyes and in the cobalt mines is accepted as a cause of tumour of the bladder. Bianchi states that fuchsin, naphthylamine, benzdine, and tar also predispose to this trouble. Levenberger's opinion on this subject is quoted by C. Mansell Moullin.<sup>2</sup> Otto Sachs<sup>3</sup> questions the influence of aniline in this respect, and is inclined to blame some of the ingredients from which aniline is manufactured.

Articles, etc., on the local effect of aniline dyes upon the bladder, have appeared by the following authorities: L. Rehn,<sup>4</sup> Langenbeck,<sup>5</sup> Huldshiner,<sup>6</sup> O. Leichtenstern,<sup>7</sup> F. Strauss,<sup>8</sup> etc.<sup>9</sup>

The azo-compound is probably of little, if any, added injurious consequence in the series of coal-tar dyes. Azo-dyes are built up on the fibre. Aniline dyes, on the contrary, dye the fibre directly. Many have been suggested as responsible for local action, but this has not been sufficiently proved. The work of Otto Sachs in this connection is important.<sup>10</sup> The presence of aniline material in the tissue was histologically demonstrated by him in some of his cases.

Sachs carried out a series of experiments on rabbits. In

<sup>1</sup> "Industrial Poisoning," trans. by Legge, 1913, pp. 114, 117, and 214.

<sup>2</sup> *Lancet*, 1914, vol. i., p. 809.

<sup>3</sup> *Arch. f. Derm. u. Syph.*, 1913, vol. cxvi.

<sup>4</sup> "On Tumours of the Bladder in Aniline Dye-Workers," Thirty-fourth Congress of the German Surgical Society, p. 220.

<sup>5</sup> "Tumours of the Bladder in Fuchsin-Workers," *Arch. f. Klin. Chir.*, by B. v. Langenbeck, vol. i., p. 598.

<sup>6</sup> *Ref. Münch. med. Wochensch.*, 1898, p. 1452.

<sup>7</sup> *Deutsch. med. Wochensch.*, 1898, vol. xxiv., p. 709. *Ref. Münch. med. Wochensch.*, 1898, vol. ii., p. 1453.

<sup>8</sup> "On Aniline Tumours," Thirty-fourth Congress of the German Surgical Society, p. 226.

<sup>9</sup> "On Diseases of the Bladder in Workers in Aniline Dye Factories," *Zeitsch. f. Gewerb. u. Gewerbshygiene*, 1910, p. 157. *Ref. in Annual Report of the Prussian Government and Industrial Laws*, pp. 390 and 391.

<sup>10</sup> *Archiv f. Derm. u. Syph.*, 1913, vol. cxvi., p. 556.

his first series, various aniline dyes were rubbed into the inner surface of a rabbit's ear at different intervals of time. Histological examination of the skin later gave the same results. In a large number of the cases, growth and proliferation of the Rete Malpighii appeared, as well as increase of the sebaceous glands, with frequently a verrucous or epithelioma-like look of the skin. In a second series of experiments, Sachs repeated Fisher's experiment of making subepithelial injections of scarlet red oil into the ears of rabbits. He was able to confirm Fisher's results—namely, that the injections caused an overgrowth of epithelial tissue. Sachs obtained similar results with some aniline dyes quite different in constitution from scarlet red, such as azo-triphenyl-methane, an acid green dye; and also with an acid light yellow dye, amido-azo-benzene (a disulphonic acid soda salt), and a madder lake (anthracene dye).

Sachs has confirmed the value of scarlet red (amido-azo-toluene- $\beta$ -naphthol) to the dermatologist, and his other researches are equally illuminating.

The most common sources of skin affections in dyeing factories are to be found in the "padding," "impregnating" or "printing," and the "jig" processes. These are the machines in which colour solutions and **bichromates** are used. Dr. Legge<sup>1</sup> described three cases of dermatitis occurring at these machines. The process consists in passing the cloth through either one or two bowl mangles or through a jig, in which is the dyeing solution.

In the "fulling" process, woven woollen cloth is placed in the washing machine, in order to remove the oil and grease. It is then transferred into a vat with soap and water, where it is rinsed. After washing, the goods pass through the fulling cylinders, to felt the ware, and prevent shrinking. The rinsing and washing processes are the ones most likely to cause irritation. Dyed cloth only causes irritation when

<sup>1</sup> Annual Report of H.M. Chief Inspector of Factories, 1905.

fulled; undyed cloth gives rise to no eruptions. The principal mordant is **potassium bichromate**. The present process, as quoted by Legge<sup>1</sup> in his report of 1905, is as follows: "The material is boiled with 10 per cent. **Glauber salts**, also **acetic acid**, and the **dye** material. Then 1 to 3 per cent. of bichromate is added. In many instances the chroming is one of the earlier processes."

The two abstracts quoted above tend to prove that the chief troubles arise during the washing, rinsing, and chroming processes. With the few exceptions mentioned, the dye itself is a negligible factor in producing dermatitis.

### Special Dyeing Processes.

1. **Logwood and cutch** are used for dyeing silk and feathers black; they require mordanting with iron salts, and later with tannin. When employing these colours on some cottons, the **chlorides** and **fluorides** of **chromium** and **stannic chloride** are used. These latter salts have a strong corrosive action on the skin. After mordanting, the material is placed in the logwood bath, the temperature of which is at boiling-point.

Logwood, because of its cheapness, is still largely used in dyeing woollen yarn, cloth, and stockings. The mordant bath will contain about  $1\frac{1}{2}$  pounds of **bichromate** of **potassium** in 200 gallons of water, acidulated with **sulphuric acid**. The goods are generally boiled by forcing steam through jets at the bottom of the pan. Later, the materials are transferred to the boiling liquor in the logwood dye-pan. In the first process, the strongly boiling solution of chrome salts and acid are intensely irritating. Particles can be carried by the escaping steam from the boiling chrome vat  $1\frac{1}{2}$  feet above the level of the liquid, thus causing extensive erythematous and vesicular lesions on the face, neck, and arms.

<sup>1</sup> Report of Inspector of German Factories, 1903.



Cases of this description have been noted by Dr. Heise and the writer.<sup>1</sup> The lesions caused by chrome were found to be remarkably painless.

When dyeing cotton cloth, acid chrome baths are avoided as much as possible, because sulphuric acid causes "tendering" of the material. In woollen cloth and yarn, however, and occasionally to cotton yarn, the bichromate is added to the hot bath containing sulphuric acid. From this combination nascent **chromic acid** is liberated, a highly caustic and oxidizing substance.

The injurious effects of chrome in the dyeing of yarn were given by Legge<sup>2</sup> in 1906. In ninety men examined 30 per cent. were free, 61 per cent. showed evidence of old chrome sores, 8·9 showed signs of active chrome sores, rag-nails, etc., and ten other men showed healed rag-nails.

**Slub-dyeing** is usually effected with **acid chrome**. In this process the sliver or roving is dyed before the wool is spun into thread. Here 9·5 per cent. of the workers suffer from some eczematous condition of the skin. The strength of the chrome solution is from 2 to 4 per cent. No large ulcers are seen as the result of this operation. The condition begins as a papular eruption round the knuckles, in the fold between the thumb and first finger, and on the palmar surface of the wrist and forearm. The rash is usually confined to these parts, but may become more general. In the early stage irritation is very great. The tops of the papules get knocked off, leaving small pin-head sized ulcers, which are co-extensive with the eruption. Legge<sup>3</sup> finds the affection a most obstinate one.

**2. Basic Dyes for Cotton.**—The material is prepared with **tannic acid**, and then fixed by an after-treatment of **tartar emetic**, **oxalate**, or **fluoride of antimony**. It is then dyed in

<sup>1</sup> *Lancet*, 1910, vol. i., p. 279.

<sup>2</sup> Annual Report of H.M. Chief Inspector of Factories, 1906.

<sup>3</sup> Annual Report of H.M. Chief Inspector of Factories, 1905.



an acidified solution of the colouring matter, acetic acid being usually employed. Wool, silk, and jute dye direct, without any mordant. Alkali blues require **soda** and **borax**, and the material is finally raised or fixed in a bath of weak **sulphuric acid**.

Sumac and tanned leather dye directly.

Leather is sometimes dyed directly by being placed in the colour-bath. This is commonly known as the "drum method."

The "table method," however, is preferable for leather, and is as follows:—The leather is stained by applying the colour to it with a brush, sponge, or pad of cloth. The leather is previously moistened by water.

**Bismarck brown**, **saffranine**, and **chrysoidine**—"meta-diamido-benzene." The last of these is used to colour the soles of cheap boots a light red shade. All three are irritants, and cases of dermatitis have been recorded in which the last had been used <sup>1</sup> in the strength of 3i. to the pint. These colours are usually mixed with vegetable acids.

Macleod <sup>2</sup> says **aurantia**, an orange-yellow dye, used to colour cheap shoes yellow, is a well-known irritant.

In **aniline black dyeing** "steam prussiate process" the cloth coming out of the ager is passed into a boiling solution of **bichromate** of **potassium** by continuous machines, or through the jig to continue the oxidation.

In the **oxidation** or **copper** process, after coming from the ager, the cloth is passed through a stronger solution containing from 2 to 6 per cent. of bichromate of potash or soda. These substances are caustic.

**Quinones** and **hydroquinones** are produced by both processes. Each has an irritant action, especially the former.

<sup>1</sup> Report Departmental Commission on Compensation for Industrial Diseases, 1907 *et seq.*, and para. 10,407 *et seq.*, § 9,674.

<sup>2</sup> Knocker, "Accidents in their Medico-Legal Aspect," 1910, p. 729. *Vide* also Thorpe, "Dictionary of Applied Chemistry," p. 220.

In dyeing wool black, the whole of the chrome salts are converted into **chromic acid**, sulphuric acid being added to complete oxidation.

**Dyeing Cotton with Chrome Yellow.**—According to Rambousek,<sup>1</sup> the cotton is saturated with **basic nitrate** or **acetate of lead**, and passed into a warm solution of **potassium bichromate**. The material is subsequently passed through milk of lime, when the yellow colour becomes converted into orange.

The writer has observed the following crude method of preparing chrome yellow paste for pigment-printing: One and a half pounds of bichromate of soda are mixed with other materials to form the paste; this is squeezed out and strained through cloths by hand, and passed into a gallon of water to form the colour. The workmen may do this continuously during a period of about ten minutes per hour. The method apparently rarely causes any inconvenience to the workers.

**3. Indigo Dyeing.**—The three methods employed for dyeing with indigo are the following:

(1) *The Copperas Vat.*—In this process **indigo**, **ferrous sulphate**, and **slaked lime** form the solution in the vat.

(2) *The Zinc-Dust Vat.*—Here the indigo in the vat is reduced by **hydrosulphate of zinc** and **lime**. The solution is used cold, but is powerfully alkaline and caustic.

(3) A more recent method is the reduction of the indigo by hydrosulphite of soda, zinc, lead, or calcium, etc.

Of these three methods, the last causes least irritation.

Legge<sup>2</sup> states that in "calico-printing" chrome holes are particularly frequent, when the discharge style consists of a bichromate paste 40 per cent. in strength. The cloth is

<sup>1</sup> "Industrial Poisoning," 1913, p. 56.

<sup>2</sup> Annual Report of H.M. Chief Inspector of Factories, 1900.

printed directly from the rollers previously dyed with indigo blue.

4. **Vat dyes** are a new class, and are at present the most important in the dyeing industry. Examples of these are the **brominated indigos**, and **indanthrene** and **carbazol** derivatives. The method of application depends upon their reduction to leuco-compounds by sodium hydrosulphites,  $\text{Na}_2\text{S}_2\text{O}_3$ , in **caustic alkali** baths. These alkaline liquors are highly irritating. They vary in temperature, some being used cold, some warm, and others boiling.

When applying vat dyes to calico-printing, the modern method of fixing is by means of the **sulphoxylates**, or the **formaldehydes** of **sodium**. After-treatment with **chrome** is requisite for many of these colours.

The workers in sulphur and indigo dye factories always wear gloves.

If improperly shod, the employees are liable to have chrome holes form on their feet, from the splashings on the flooring round the chrome tanks.

5. The **direct** or **substantive** group. This is so-called because the dyes have sufficient affinity for cotton-fibre to do away with the necessity for using mordants.

The following is the process employed for direct dyes :—

- (1) The pieces are first dyed in boiling water with salt and the colour required, and the coupled dyes are further treated as follows :—
- (2) Diazotized, that is, nitrated in a bath of **sodium nitrite** and **hydrochloric acid**.
- (3) They are developed by such materials as  $\beta$ -**naphthol**, **resorcin**, or **diphenylamine diamine** in a strongly **alkaline** warm solution.

The colour is rendered *fast* for washing by the above developers.

In order to improve the fastness of direct dyes, the cotton



is finished off after dyeing by being run through a jig containing a cold, weak solution of **formaldehyde**, four to five spoonfuls being used to the gallon.

The following metallic treatment is adopted to fix cotton with certain direct blue colours :

To each gallon of water in the dye-jig add—

3 per cent. by weight of **copper sulphate**,  
2 per cent. of **chromate** of **potassium**, and  
3 per cent. of **chromium fluoride** and **chrome aluminium** in an acidulated **acetic acid** solution.

Bring the water to the boil.

The alkalinity of the above coupling solutions, the acidity, and direct action, of the chromic acid, as well as the irritation of the developers, have a strongly injurious action upon the skin.

6. **Sulphur** dyes belong to a group of “direct tar dyes,” used for cotton and linen. The colour is dissolved in hot water with double the amount of the reducing agent, **sodium sulphide**, and a quarter of the amount of **soda ash**. The mixture is kept just below boiling-point for fifteen minutes.

These solutions are also strongly alkaline, and have an irritating action.

Some of the sulphur colours are further treated by passing the cloth through the jig containing a metallic salt solution, similar to that described above for “direct” dyes.

### Dyeing.

In all dye works the colours used are very apt to stain the hands of the workers. These stains are removed at least once a day, when the work is over, by the men washing their hands in the so-called **chemic**. This is a mixture of **soda ash** and **hypochloride** of **lime**. A usual formula is, 1 pound of each added to 3 gallons of water. This forms a bleaching solution of sodium hypochlorite. Some of the men use it two



or three times a day. Besides its powerful detergent and bleaching properties, the hypochlorite causes profuse sweating of the hands, which has been known to last more than twenty-four hours. Employers restrict the use of this cleansing fluid when possible to one application daily, on account of its liability to render the skin tender and susceptible. Blaschko<sup>1</sup> already drew attention to this fact in 1891. He described the perspiration, also the tender and painful sensations felt at the tips of the fingers and at the knuckles. He noted further that the skin became thin, and was liable to crack.

In estimating the local action of any particular dyeing ingredient upon the skin, the very general use of this or a similar cleanser must be remembered. A common fault was to immerse the hands in alum solution. This intensified the irritation, and caused a deposit of **aluminium oxide** on the skin; there was resultant hardening with a liability to crack. A weak solution of bisulphite of soda is far preferable.

**Bisulphite of soda**,  $\text{NaHSO}_3$ , is a powerful reducing agent and "antichlor." If a weak wash of this substance is employed immediately after exposure to chromic acid and chrome compounds, whether used as colours, mordants, or oxidizers, their irritant action is removed, and the palliative effect of the drug is valuable to the skin.

After the use of this reducer, if chrome holes are present, each should be flushed freely with a weak solution of **tincture of iodine**, "gr. ii. ad  $\bar{3}$ i.," to render it aseptic, and immediately apply a piece of clean cloth, well saturated in **acetone collodium**.

Some colour stains, whether on cotton, wool, leather, wood, or the skin of the hands, can be removed immediately, without irritation, by **hydrosulphite of soda** in warm solution, owing to its exceptionally powerful reducing action.

The bichromates are used as **mordants** in wool-dyeing

<sup>1</sup> *Deutsch. med. Wochensh.*, 1891, vol. xvii., p. 303.

more than any other metallic salts; in cotton-dyeing they are employed as **oxidizers**, and not as mordants.

The following references to aniline dyes are taken from a long and comprehensive paper by Otto Sachs:<sup>1</sup>

WILSON, ERASMUS: On Cutaneous Inflammation from Aniline Dyes, *Journ. Cut. Med.*, April, 1869.

WEBER, KARL: On Aniline Dyestuffs, *Monatsh. f. prakt. Derm.*, 1886, p. 230.

BLASCHKO, A.: The Cutaneous Diseases of Aniline Workers, *Deutsch. med. Wochensch.*, 1891, Nos. 45 and 46.

SENN, A.: Typical Opacity: Density of the Cornea in Aniline Dyers, *Korrespondenz-Blatt f. Schweizer Aerzte*. Ref. Virchow-Hirsch, 1897, vol. ii., p. 437.

GRANDHOMME: The Manufactures of the Dyeworks of Meister, Lucius Brüning Company, Ltd., at Hoechst am M., Fourth Edition, Frankfurt-on-Main, 1896, p. 87.

GRÄFFLIN, A.: Experimental Researches as to the Injurious Effects of Aniline Dyes in Powder Form on the Mucous Membrane of the Rabbit's Eye, *Zeitsch. f. Augenheilk.*, 1903, vol. v. Ref. in *Schmidt's Jahrbücher*, 1906, vol. ccxcii., p. 96; also *Zeitsch. f. Augenheilk.*, 1905, vol. ccxxvi. *et seq.* Ref. in *Schmidt's Jahrbücher*, vol. cclxxxix., p. 210.

HERXHEIMER: On Occupational Diseases of the Skin, *Deutsch. med. Wochensch.*, 1912, vol. xxxviii.

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<sup>1</sup> *Arch. f. Derm. u. Syph.*, 1913, vol. cxvi., p. 556.

## CHAPTER VII

## DERMATITIS VENENATA

**Nat. Order, Primulaceæ.**—Numerous plants are known to exert a severe irritant effect if they touch the skin.

The *Primula obconica*, or poculiformis, "Chinese primrose," is one of the most familiar. Its extreme popularity for decorative purposes is shown by the frequency with which its charming pink flower is seen in English greenhouses. Idiosyncrasy is a marked feature in plant dermatitis. The writer knows a lady in whom this primrose sets up its characteristic trouble, whereas to her gardener it is quite innocuous. According to Rost,<sup>1</sup> this plant originally came from Central Asia. In 1880, and again in 1889, Hance described the eczematous inflammation of the skin due to handling this variety of primula. Since then it has been referred to by every writer, and particularly by J. C. White<sup>2</sup> in 1889.

The rash caused by the *Primula obconica* and *Sinensis* "*Strasburger*" is described by Sabouraud<sup>3</sup> with his usual minuteness. He says: "It is composed of numerous closely placed small, shiny, red, punctiform papules, the size of the eye of a needle, and is accompanied by much smarting and itching." In treating it Sabouraud recommends lime-water and oil.

<sup>1</sup> *Medizinische Klinik*, 1914, Nos. 3, 4, and 5, pp. 101, 155, and 198.

<sup>2</sup> "Dermatitis Venenata," 1889.

<sup>3</sup> "Entretiens Dermatologiques," 1913, p. 383.

Sequeira<sup>1</sup> gives an illustration of this dermatitis in his book.

An unusual form is recorded by Jamieson,<sup>2</sup> in which the condition simulated that of ringworm.

Numerous other cases have been reported by different observers, including Rost,<sup>3</sup> who recently published a long article on the toxic effects of *Rhus toxicodendron*, the *Primula obconica*, and *Rhus vernicifera*.

The following is an account of some of the very large number of examples of **dermatitis venenata** observed by different authorities, together with the plants which have been answerable for the conditions :—

Nat. Ord., *Anacardiaceæ*. The majority of the *Sumac* genus is a more or less poisonous group.

*Rhus dermatitis* is well known in North America. Its classical form is caused by *Rhus toxicodendron* "poison ivy"; the fresh leaves contain an acrid juice. It is distinguished from other suspected creepers of a similar appearance by its possession of three leaflets instead of five.

*Rhus venenata* (Syn., *Rhus vernix*, poison sumac, poison elder, poison dogwood, poison ash, swamp sumac) is a very poisonous shrub, 6 to 18 feet high, growing in swampy places in the United States and Canada, as well as in Japan. In Europe it is usually only found in botanical gardens. Working amongst the saplings is associated with considerable inconvenience and distress, as the subjoined instances show.

*Rhus vernicifera* in Japan is named the lacquer-tree, from the dark-coloured varnish collected from it. In the manufacture of this varnish, and occasionally when handling the finished product, trouble is apt to arise. Buraczuski<sup>4</sup> mentions

<sup>1</sup> "Diseases of the Skin," 1911, p. 79.

<sup>2</sup> *Brit. Journ. Derm.*, 1893, vol. v., p. 140.

<sup>3</sup> *Med. Klin.*, 1914, Nos. 3, 4, and 5, pp. 101, 155, and 198.

<sup>4</sup> *Wien. klin. Rundschau*, No. 50, p. 955. *Brit. Journ. Derm.*, 1903, vol. xv., p. 190. Case also reported by Rost, *Wien. med. Wochens.*, 1914, vol. xxvii., p. 101.



a gardener in the Vienna Botanical Gardens who, after felling a tree, developed wheals on the exposed parts of his body, face, forearms, hands, and genitals. Similar effects have resulted after repotting the young plants. This tree grows also in Upper Tonquin; the varnish obtained from it is much used by the Annanites and Chinese to lacquer their furniture. Three cases of dermatitis occurring in French soldiers were described by Billet.<sup>1</sup>

A dermatitis results if the fresh juice of the *Rhus metopium* (coral sumac, mountain machineel) is smeared on the arms. This tree grows in tropical America, and has been supposed to be the source of "hog" or "doctor gum." It is known locally as the Jamaica sumac.<sup>2</sup>

Schamberg<sup>3</sup> illustrates the dermatitis which results from carelessly handling the bruised or cut leaves, thus allowing the sap to reach the skin. Intense irritation is started, followed by inflammation and vesication.

Mr. J. Maiden,<sup>4</sup> Director of the Botanical Gardens, London, gives nineteen varieties of plants which induce irritation of the skin. Amongst them he mentions the *Rhus diversiloba* (poison oak) and the *Rhus radicans*, a climbing variety of the *Rhus toxicodendron*, commonly known as "poison vine."

According to Pfaff,<sup>5</sup> the poison of the *Rhus* species is a fixed oil, *toxicodendrol*, contained in the active juices;  $\frac{1}{1000}$  milligram in 2 drops of oil will set up localized oedema and vesication. Straton<sup>6</sup> considers that there is a possibility of these rashes becoming generalized.

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<sup>1</sup> "Deux ans dans le Haut Tonkin," Lille, 1896, *Brit. Journ. Derm.*, 1903, vol. xv., p. 190.

<sup>2</sup> *Brit. Med. Journ.*, 1899, vol. i., p. 1140.

<sup>3</sup> "Diseases of the Skin and the Eruptive Fevers," 1911, p. 161; and "Principles and Practice of Dermatology," pp. 345, 346.

<sup>4</sup> *Lancet*, 1904, vol. i., p. 408.

<sup>5</sup> *Journ. of Exp. Med.*, 1897, vol. ii., p. 181.

<sup>6</sup> *Brit. Med. Journ.*, 1912, vol. ii., p. 1139.

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### VANILLA DERMATITIS.

**Nat. Order, Orchidaceæ.**—*Vanilla plantifolia* is a climbing parasitic perennial, and a native of Mexico. The fruit is gathered before it is quite ripe, dried by a special process, and steeped in oil. It is used principally as a perfume and flavouring ingredient.

A condition named **vanillaism** occurs in the workers who sort, cleanse, and pack the pods. Besides the general symptoms, secondary local eruptions are seen on the skin, such as œdematous swelling of the hands and face. Oppenheim<sup>1</sup>

<sup>1</sup> *Wien. klin. Wochensch.*, 1914, vol. xxvii., p. 63.

states that these symptoms are supposed to be due to an ethereal oil.

Dermatitis is of frequent occurrence in factories where vanilla is used for confectionery purposes. The pods are imported in drums containing spirits. These splash the arms and sometimes the faces of the workers. Considerable irritation, erythema, papules and even vesicles develop, and persist for two or three weeks after contact with the liquid.

Dr. James C. White<sup>1</sup> mentions a case of poisoning in a *vanilla vendor*. This was the man's third attack. His face was puffy, the eyes partly closed from the swollen eyelids. There were various inflammatory lesions on the wrists and forearms on one side. White thinks the irritation may be due, not to the acarus, which is common in the pods, but to the oil of cachew-nut, called **cardol**. This oil is used to colour or preserve some of the pods. White was led to this conclusion from the circumstance that a lady patient of his received from the West Indies some cachew-nuts. Upon opening them she developed vesicles, bullæ, and general swelling, which lasted ten to fourteen days. White says the Oriental cachew is called the "Indian marking-nut." It colours black any substance with which it comes in contact, and has the same power of staining the skin black, and setting up irritation as the *Rhus*.

Cardol is obtained from the stone fruits of the *Anacardium occidentale* and *Anacardium orientale* under the names of "Cardolum vesicans" and "Cardolum pruriens." The titles given to these balsams sufficiently indicate their action.

Brock and Fage<sup>2</sup> reported a case of "œdemato-erythemato papular eruption" in persons who put the powder of *Vanilla plantifolia* into packets. The rash extended over the hands, forearms, neck, face, and throat. The authors, after describing the trouble, said: "This condition is well known, and its

<sup>1</sup> *Boston Med. Journ.*, 1893, vol. ii., p. 1272.

<sup>2</sup> *Lancet*, 1906, vol. i., p. 35.

cause has been variously attributed to an acarus, moulds, growths, to the tincture of catechu, with which the vanilla is coloured, or to the treatment applied to remove any moulds that may be present."

R. F. Hiley<sup>1</sup> notes the case of a Hindoo lad, aged eighteen, who, after handling vanilla, rubbed his face with his hands and subsequently developed a pustular rash on the arms, face, abdomen and legs. Other writers support the view that the volatile oil, called cardol, may provoke the irritation.<sup>2</sup>

According to Oppenheim,<sup>3</sup> another of the orchids, *Cypripedium calceolus* (lady's slipper), indigenous to North America and Canada, incites dermatitis.

Other plants causing rashes of the skin include—

Nat. Ord., *Conifereæ*. *Balsamum Gileadense*, or balm of Gilead.

Nat. Ord., *Apocynaceæ*. The dogbane family.

*Nerium Oleander*, or Oleander, an ornamental shrub, native of the Mediterranean region; all parts of the plant contain an active and irritant poison.

Nat. Ord., *Rutaceæ*. *Ruta*, or rue, a European perennial plant (Pusey).

Nat. Ord., *Cannabinaceæ*. *Hops* when picked.

Nat. Ord., *Euphorbiaceæ*. *Spurge*, from which a gum-resin is obtained for making rubefacient plasters.

Nat. Ord., *Lauraceæ*. The *Laurel* and different forms of *Thrapsia* (Nat. Ord., *Apiaceæ*) from which a plaster is made, induce dermatoses of the hands and face.

Nat. Ord., *Pomaceæ*. *Cotoneaster microphylla*, a genus of shrubs and small trees closely allied to the hawthorn and medlar. Cooper<sup>4</sup> recorded the case of a man who developed

<sup>1</sup> *Lancet*, 1909, vol. i., p. 1433.

<sup>2</sup> *Revue Médicale de la Suisse*, October, 1899, vol. xx.; also *Brit. Med. Journ.*, 1900, vol. i., p. 30a, 65.

<sup>3</sup> *Wien. klin. Wochensch.*, January 15, 1914, No. 3, p. 63.

<sup>4</sup> *Australian Med. Gaz.*, January 20, 1900 (Abs.); *Brit. Journ. Derm.*, 1900, vol. xii., p. 183.



urticaria when cutting hedges, as well as three other instances in which similar conditions occurred.

Nat. Ord., *Compositæ*. *Humea elegans*,<sup>1</sup> "a graceful drooping plant with a red spiky flower, a native of Australia, induces a violent dermatitis." When bruised it emits a balsamic odour. Dawson<sup>2</sup> demonstrated that acute exudation of the skin might be set up by handling chrysanthemum flowers. Whitfield<sup>3</sup> includes King Edward's daisies and fox-glove (Nat. Ord., *Scrophulariaceæ*) in this category.

*Doronicum pardalianches*, Roman leopard's bane, induced a profuse rash in a lady who was gathering the flowers. Her face suffered mainly, but her hands and feet were affected also.<sup>4</sup> This is a European herb of the *Compositæ* order; the root contains acrid and poisonous juices. According to Oppenheim,<sup>5</sup> another plant of this order is the *Helianthus* (sunflower), a native of America, but well known elsewhere as a skin irritant.

Nat. Ord., *Myrtaceæ*. J. Maiden<sup>6</sup> states that the *Eucalyptus hemiphloia*, the Australian gum-tree, will cause irritation even by proximity.

Nat. Ord., *Araliaceæ*. *Hedera helix*, the common ivy. The black berries are emetic and purgative. Munro<sup>7</sup> reported a case of dermatitis from this creeper, in which a vesicular eruption resembling zoster appeared. It began after the application of ivy leaves and vinegar to corns; later it always recurred in the same patient whenever wet ivy leaves were touched.

Nat. Ord., *Amaryllidaceæ*. Dermatitis venenata caused by

<sup>1</sup> Walker, N., "Introduction to Dermatology," p. 132.

<sup>2</sup> *Brit. Journ. Derm.*, 1906, vol. xviii., p. 439.

<sup>3</sup> *Lancet*, 1914, vol. i., p. 607.

<sup>4</sup> *Brit. Med. Journ.*, 1898, vol. i., p. 1244.

<sup>5</sup> *Wien. klin. Wochenschr.*, 1914, vol. xxvii., p. 63.

<sup>6</sup> *Lancet*, 1904, vol. i., p. 1204.

<sup>7</sup> *Australian Med. Gaz.*, January 20, 1900 (Abs. *Brit. Journ. Derm.*, vol. xii., p. 183).

the juice of the *daffodil* stalk is well known, and is fully recorded by A. W. Williams.<sup>1</sup> This condition is very prevalent in the Scilly Isles amongst the pickers and packers of the flowers, their hands being chiefly affected. The height of the season is about March. It is not definitely known what is the poison of the *Amaryllidaceae*, but the extracts of both bulbs and flowers are emetic. The rash may be erythematous, papular, vesicular or pustular, acute or chronic, but rarely generalized. According to David Walsh,<sup>2</sup> a broken skin and susceptibility predispose to the trouble.

Nat. Ord., *Liliaceae*, group *Scilleae*. Professor R. S. Harvey Gibson<sup>3</sup> asserts that the *Asparagus officinalis* of the *Liliaceae* order sometimes has an injurious action on the skin. Freeman,<sup>4</sup> in writing on this subject, states that imported hyacinth bulbs occasionally cause a mild dermatitis when being handled and cleaned, the rash being confined to the hands, arms and face. It is uncertain whether the irritation is due to the numerous crystals of lime surrounding the bulb, or to the abundant masses of acari found inside the sheathing of the root.

Nat. Ord., *Leguminosae*. According to Pusey,<sup>5</sup> *Mucuna pruriens* (cowhage) induces dermatitis. It is a climbing, tropical plant, cultivated in both the East and West Indies, where it is used as a vermifuge. The short, brittle hairs growing on the pods have long been known to be very irritating.

W. Kenneth Wills<sup>6</sup> came across cases of **barley itch** amongst dock-workers engaged in unloading certain kinds of foreign barley. He thought this might be due to the presence of cowhage, although he found an acarus, not the *Sarcoptes homines*, present in some samples. This itch, how-

<sup>1</sup> *Lancet*, 1910, vol. ii., p. 1769.

<sup>2</sup> *Brit. Med. Journ.*, 1910, vol. ii., p. 854.

<sup>3</sup> Report of the Departmental Committee on Compensation for Industrial Diseases, 1907, § 646 *et seq.*

<sup>4</sup> *Brit. Journ. Derm.*, 1907, vol. ix., p. 66.

<sup>5</sup> "Principles and Practice of Dermatology," 1907, p. 344.

<sup>6</sup> *Lancet*, 1908, vol. ii., p. 1879.

ever, is more generally ascribed to the acarus *Sphaerogyna cerealella*, an epidemic due to this being described by Pascal.<sup>1</sup> The patients presented a pruriginous desquamating, scarlatini-form erythema, with vesicules or wheals beginning in circumscribed patches, and becoming confluent over the exposed parts. The epidemic occurred in a bakery amongst barley-sifters; the grain was found to be infested with a small moth, on the larva of which the acarus *Sphaerogyna cerealella* was found. (*Vide* p. 142.)

J. C. White<sup>2</sup> gives an instance in which *oil of cassia* (Nat. Ord., *Leguminosae*), used as a cheap substitute for oil of cinnamon, affected the hands, face, and abdomen of a girl employed in dipping toothpicks into the oil to give them an agreeable flavour. Her hands were inflamed and covered with vesicules, her face red and blotchy. The abdomen was similarly affected, probably due to the spreading of the oil by contact with the hands during sleep. Oil of cassia is distilled from Chinese cinnamon bark.

Nat. Ord., *Umbelliferae*. *Angelica*, also called cow-parsley, when being cut green, will produce extensive dermatitis and blistering in certain persons. Two confectioners were affected when gathering this plant for the purpose of candying as a sweetmeat. It is probable that "angelic acid" is the toxic agent.<sup>3</sup>

*Heracleum* (common cow-parsnip). A papulo-vesicular eruption is liable to appear on the hands and face of persons handling and weeding parsnips, and is accompanied by much heat and itching. Jamieson<sup>4</sup> states "that the acidity of the sap varies with the season of the year and sensibility of the workers." Another instance of this dermatitis is recorded by Stowers.<sup>5</sup>

<sup>1</sup> *Brit. Journ. Derm.*, 1901, vol. xiii., p. 37.

<sup>2</sup> *Boston Med. Journ.*, 1897, p. 78.

<sup>3</sup> *Brit. Journ. Derm.*, 1899, vol. xi., p. 287.

<sup>4</sup> *Edin. Med. Journ.*, 1897, vol. ii., p. 601.

<sup>5</sup> *Brit. Journ. Derm.*, 1897, vol. ix., p. 285.



*Pastinaca*, a plant growing in southern Europe belonging to this order, resembling the parsnip, from which a gum-resin, called opoponax, is obtained. Oppenheim<sup>1</sup> considers that its juice has an acrid effect on the skin.

Nat. Ord., *Polygonaceae*. The *Polygonum punctatum* (smart-weed) produces an eruption. A British species, common in damp places, has rubefacient leaves; hence the name water, or poor man's, pepper, given to it.

A striking example of susceptibility to the acrid juice of the common knot-grass, *Polygonum aviculare*, is recorded by Lloyd.<sup>2</sup>

Nat. Ord., *Urticaceae*. The acrid, milky sap of the young-cut shoot or leaf-stalk of the common *fig* may cause a rash. This soon passes off, to be followed by a permanent bronze-coloured pigmentation confined to the parts the sap has touched. The pigmentation has been stated to last for thirty years. The maculæ are not raised, and there is no hyperkeratosis, such as is caused by chestnut-juice. Straton<sup>3</sup> states that there is no resultant pigmentation if the hands are washed at once. Some varieties of this genus are actively purgative and anthelmintic.

David Walsh<sup>4</sup> states, on the authority of Bernard Smith, that formic acid is the well-known poison of the nettle *Urtica divica*, a member of this order.

**Satinwood dermatitis** resembles that caused by primula plants. It spreads over the arms and face, but does not affect the conjunctiva, mouth, or penis. Headache and anorexia are frequent, but there is neither pyrexia nor albuminuria. Dr. Siegheim,<sup>5</sup> in describing the condition in twenty-five cabinet-workers, says the rash disappears in a few days, and is caused by the oil in the wood.

<sup>1</sup> *Wien. klin. Wochensh.*, 1914, p. 63.

<sup>2</sup> *Brit. Med. Jour.*, 1914, vol. ii., p. 837.

<sup>3</sup> *Brit. Med. Journ.*, 1912, vol. ii., p. 1139.

<sup>4</sup> *Ibid.*, 1910, vol. ii., p. 854.

<sup>5</sup> *Lancet*, 1909, vol. ii., p. 1636.

Dr. Auld<sup>1</sup> examined the sawdust of satinwood and extracted 1 per cent. of oil, but this oil did not give rise to irritation. He, however, isolated an alkaloid, which he called **chloroxytonine**, and there is little doubt that this is the cause of the dermatitis.

H. Jones, of Ibrox,<sup>2</sup> investigated this affection in a joiners' shop of a Govan shipbuilder's yard. The rash appeared on the face, neck, hands, and wrists, showing an acute inflammation resembling erysipelas. There were redness and swelling of the face, neck, and ears; the eyes were closed and the skin hot, but there was no fever. In this disease the skin becomes moist, and then desquamates. First attacks are slow of onset, but sharp relapses are of frequent occurrence. Any form of eczema seems to predispose to the trouble.

Satinwood comes from both the East and West Indies, the latter variety being regarded as injurious to the artificers. Surgeon-General Bidie<sup>3</sup> states that the East Indian satinwood is quite harmless, just as valuable, and can easily be substituted for the West Indian variety. This opinion, however, is contrary to Legge's, who considers that East Indian satinwood is more irritating than West Indian. Affections of the skin in the shipbuilding yards of London, Glasgow, and Bristol were recognized as being due to the East Indian variety.<sup>4</sup>

The irritating and inflammatory properties of the Japanese nut-tree *Tagayasan* have been described by E. Iwakawa.<sup>5</sup> The powder found in the fissures and cavities of this wood is sulphur-yellow, but becomes brownish-violet when exposed to the atmosphere.

<sup>1</sup> *Lancet*, 1909, vol. i., p. 1703. *Vide* Report of the Departmental Committee on Compensation for Industrial Diseases, 1907, § 9887 *et seq.*

<sup>2</sup> *Brit. Med. Journ.*, 1904, vol. i., p. 1484.

<sup>3</sup> *Ibid.*, 1905, vol. i., p. 74.

<sup>4</sup> Annual Report of H.M. Chief Inspector of Factories, 1907.

<sup>5</sup> *Arch. f. exp. Path. u. Pharmacol.*, 1911, vol. lxv., p. 311.

According to Mr. Robinson<sup>1</sup> the following woods are considered to have an irritating effect upon the skin: Some ebonies, magenta rosewood, West Indian boxwood, cocos-wood, partridge-wood, teak, olive-wood, and Borneo rosewood, though in the last expert examination revealed no irritant properties.

Sequeira<sup>2</sup> confirms the statement that an eczema-like eruption is seen in the workers of cocos-wood, from which flutes are made.

*Gonioma Kamassi*, a timber coming from the Congo and Cameroons, used for making shuttles, also called South African boxwood, was not mentioned by Legge as causing any irritation during his investigations in 1908.

Evans<sup>3</sup> recorded six cases of **teak dermatitis**, due to sand-papering the hard heart of the wood.

Dr. J. F. Hornsey<sup>4</sup> reports a form of dermatitis venenata occurring in British North Borneo, due to a tree called *Rungus* or *Ringus* by the natives. It is customary for them to go down to the river to bathe before nightfall and, if by any chance they come in contact with this tree, the skin becomes affected with intolerable itching within the next twenty-four hours. This is followed by a rash formed by clusters of raised red papules. It appears first on the parts of the body which have actually come in contact with the poisonous plant, and then spreads. As a rule there is some rise of temperature and general malaise. In twenty-four hours the papules become vesicles, or even large bullæ; they are filled with clear serous fluid, and tend to become confluent; they then burst, the serous fluid becoming inspissated to form yellow crusts. In very severe cases considerable fever prevails, as a result of secondary infection. Foul ulcers are

<sup>1</sup> Annual Report of H.M. Chief Inspector of Factories, 1907.

<sup>2</sup> "Diseases of the Skin," 1911, p. 78.

<sup>3</sup> *Brit. Journ. Derm.*, 1905, vol. xvii., p. 447.

<sup>4</sup> *Brit. Med. Journ.*, 1914, vol. i., p. 759.



sometimes seen. The lesions are specially noticeable where skin and mucous membranes meet, as around the lips and nostrils. The ears are also usually attacked. The normal course of this disease is five to seven days in mild cases. It leaves but little permanent disfigurement, and, as far as Dr. Horsley knows, no deaths from simple *rungus*-poisoning have been recorded. The disease is occasionally followed by pneumonia.

Coolies cutting jungle or working on tobacco and rubber plantations are those most likely to be affected. They know the tree well, and say the sores are due to contact with the fresh juice which exudes when it has been cut. The author discredits this view, however, and believes the dry branches are equally poisonous. The juice is clear, and exudes from between the cortex and the wood; when dry, it is a dull pitch-black colour. The tree attains considerable size, some of its branches being 3 inches in diameter; the leaves resemble those of the *jaborandi*. After macerating them for several days in rectified spirit a chlorophyll-coloured tincture was obtained, which unfiltered showed a powdery deposit. On microscopic examination, many spherules of an intense blue-black colour were found, some possessing a single spicule. It is impossible at present to say whether these spicules are the spores of some fungus washed off the surface of the leaves, or droplets of an oleo-resin extracted by the spirit. It is evident, however, that the spicules do not cause the disease by mechanical irritation, as the lesions appeared in a mild form when the filtered tincture, free from these bodies, was painted on the skin. The remaining insoluble refuse can also be excluded as a causative factor for the same reason. The disease is contagious—that is to say, the irritation from an affected person can be contracted by a healthy one who has not handled the wood. Nevertheless, the tree is manipulated with impunity by some individuals.

## CHAPTER VIII

## ZOETIC DERMOPATHY

## Butcher's Pemphigus.

BUTCHER'S **pemphigus** is a disease contracted by *butchers* and others handling certain **diseased animal tissues**.

Colcott Fox<sup>1</sup> names the condition "acute **febrile grave pemphigus**." He gives an illustration of the disease, and his article contains detailed literature on the subject. Pernet, who had eight cases, says the origin is usually a wound in the finger. This is followed by high fever, and often ends fatally. The bullæ appear in twenty-four to forty-eight hours after inoculation. There is no surrounding redness. The bullæ become either hæmorrhagic or puriform, and eventually confluent. Brocq collected twenty-five cases, and of these seventeen patients died, usually between the tenth and fifteenth day.

There are papules, pustules, and bullæ on the limbs and body; pustules and bullæ on the soles of the feet; and strings of vesicles and bullæ, with areolæ of inflammation around them, on the neck. Sometimes there is an intensive general erythematous rash on the chest and body, followed by much general desquamation.<sup>2</sup>

<sup>1</sup> Allbutt and Rolleston's "System of Medicine," 1911, vol. ix., p. 427.

<sup>2</sup> *Lancet*, 1903, vol. i., p. 1359. *Vide* also Pernet's case, *Lancet*, 1895, vol. ii., p. 499; and *ibid.*, 1898, vol. ii., p. 1397.

These skin affections have been chiefly described by Pernet and Bulloch.<sup>1</sup>

Professor Robert Saundby<sup>2</sup> records a typical **pemphigoid** condition in a butcher lad, who recovered. The skin eruption, sore throat and headache, lasted eleven days. Three weeks previously the patient cut his finger when at work. As the wound did not heal, it was poulticed. By the end of ten days he was too ill to attend to his work, and a bleb appeared below the left eye. The eruption covered his face and head, involving the mouth and tongue, and appeared round the anus. The lips and tongue were much swollen. The eruption consisted of oval bullæ  $\frac{3}{4}$  inch in their longest diameter, containing sero-purulent fluid. Each bulla was surrounded by a pink areola. On admission to hospital the boy's temperature was 100° F., pulse 84. There was a slight trace of albumin in the urine. Examination of the blood proved normal. There was no eosinophilia. Cultures from the blebs showed the coli bacillus. The lad was cured in three weeks under arsenic. Saundby says this case differs from the classical description by the mildness of the constitutional disturbances, and by the absence of the diplococcus described by Demme, and confirmed by Bleibtrea and Bulloch.

*Pemphigus acuta* is a septicæmic type of affection found in butchers, and *handlers* of raw hides. The incubation stage sometimes lasts for months.<sup>3</sup> Cases are described by Pernet and Bulloch,<sup>4</sup> Bowen,<sup>5</sup> and others.

In the Annual Report of the Belgian Inspection of Labour, 1896, Glibert<sup>6</sup> noted a disease found on special fingers of *furriers*. These men scrape and hair the **skins** of **rabbits**. The condition is due particularly to splitting the tissues on

<sup>1</sup> *Brit. Med. Journ.*, 1895, vol. ii., p. 1554; *Brit. Journ. Derm.*, 1895, vol. vii., p. 120; *ibid.*, 1903, vol. viii., p. 157.

<sup>2</sup> *Lancet*, 1904, vol. ii., p. 946.

<sup>3</sup> *Brit. Journ. Derm.*, 1896, vol. viii., pp. 157 and 205.

<sup>4</sup> *Journ. Cut. Dis.*, 1904.

<sup>5</sup> *Practitioner*, 1909, vol. i.

<sup>6</sup> Oliver, "Dangerous Trades," 1902, p. 270.



the under-surface of the skin, between the skin and fascia. Generally the thumb and middle finger are attacked; sometimes they alone. At another time all the fingers will be affected. The nails appear to be destroyed, and fall off eventually. Two illustrations are given.

Dr. Matzenauer<sup>1</sup> reported six cases of pure palmar hyperkeratosis occurring in *butchers* in Vienna. The skin of the fingers and palms of the hands was thickened about  $\frac{1}{8}$  inch, the surface of the skin being so numerously indented with pits and depressions as to give it the appearance of a sponge. This condition was not present in childhood, and disappeared when work was abandoned. There was never any inflammation around the callosities. This keratosis differs from that of *arsenicalis*, in which the skin shows a coarse, hard, uneven surface, not the pomegranate appearance of this dermatitis. All the men affected were employed in butchers' shops, removing hair from pigs by means of hot water and **rosin**. Rosin is used to cause the epidermis of the pig's skin to swell, and thus loosen the hairs. Histologically, this dermatitis was found to be a pure hyperkeratosis.

**Erysipeloid** (Rosenbach) is a condition of the skin due to the infection of **decomposing matter**. According to Schamberg,<sup>2</sup> there are as a rule no constitutional symptoms. The disease begins as a dark red or violaceous sharply defined margined patch at the site of infection. The skin is tense and slightly tumefied, the fingers and hands being the common site of affection. There is gradual peripheral extension, with a sharply defined deep red border. The disease, which is accompanied by heat and smarting, spreads more slowly than erysipelas, and the lesions rarely extend beyond the wrist. The condition lasts from one to six weeks, and then disappears without desquamation. It occurs in *fish-*

<sup>1</sup> "Diseases of the Skin," 1908, p. 149.

<sup>2</sup> *Lancet*, 1904, vol. i., p. 199.

*dealers* and *butchers*. Gilchrist<sup>1</sup> recorded 329 cases, all but six of which were due to the bites of **crabs' claws**. He could not find Rosenbach's organism, and was unable to detect any special one. The condition is infective.

**Dermatitis Contagiosa Pustulosa Canadensis** was introduced into this country from Canada in 1877, and distributed throughout Europe by British **horses**. Veterinary surgeons call it "horse-pox." It consists of vesicles, pustules, and scabs, resembling human impetigo. Schindelka<sup>2</sup> says it is identical with human impetigo contagiosa. In the horse its special site is the region of the saddle and girths. It is conveyed from horse to horse by **harness, horse-cloths, and rugs**. It is extremely contagious to both men and horses, *stablemen* being severe sufferers. The organism causing it is the **streptococcus**.

The pemphigoid eruption contracted from **cows**, known as "**white**," or **blister-pox**, is probably due to the same organism.<sup>3</sup>

Galloway<sup>4</sup> records the case of a *stableman* suffering from a pimple on the chin and another on the angle of the mouth, which turned into blisters. He regarded this as horse-pox.

The common **warts** found on dogs and oxen are communicable to man, according to Audry and Suffran.<sup>5</sup>

### Post-mortem Wart, or Verruca Necrogenica.

**Verruca necrogenica**, or post-mortem wart, is a *tuberculous* disease caused by local inoculation from open tuberculous disease, and from the cadaver, animal or human.<sup>6</sup> It is found in *physicians, dissecting-room* and *post-mortem attendants*,

<sup>1</sup> Schamberg, "Diseases of the Skin," 1908, p. 149.

<sup>2</sup> *Brit. Journ. Derm.*, 1905, vol. xvii., p. 390 (Abs.).

<sup>3</sup> *Ibid.*, 1909, vol. xxi., p. 72.

<sup>4</sup> *Ibid.*, 1889, vol. i., p. 156.

<sup>5</sup> *Ann. de Derm. et de Syph.*, October, 1908, p. 545.

<sup>6</sup> Allbutt and Rolleston, "System of Medicine," 1911, vol. ix., p. 483.

*nurses, undertakers*, and in the “butchering” and “smoke-drying” trades. Oppenheim<sup>1</sup> has observed a similar condition amongst straw-hat workers. It begins at the site of abrasion as an inflammatory vesico-pustule of slow development, which gradually becomes bean-sized, flattened, and covered with a horny and warty surface, or by crusts. The fingers and knuckles are favourite sites. The growth should be removed, for without attention the condition spreads; but it is a rare thing for it to lead to general tuberculosis.

### Anthrax.

**Anthrax**, or malignant pustule, is a highly infective disease caused by the *anthrax bacillus*, and is practically only found in the herbivora. Under certain circumstances it is possible for man to be infected by the disease, the chief sufferers being workers amongst the wool hides and hair of affected animals.

Cases have occasionally been reported as occurring amongst *butchers, knackers, farm labourers, saddlers, shoemakers, furriers, glue-makers, mattress-makers, and tanners*.

Legge<sup>2</sup> says that the extraction of dust in the heavy woollen industry (which comprise the technical operations of wool-combing, sorting, and similar work) is one of the most dangerous processes, and very liable to give rise to cases of anthrax.

It is of much rarer occurrence in *blanket-makers, hair-dressers, curlers, carders*, and *sorters*, as well as those making brushes with foreign pig’s bristles.

Legge<sup>3</sup> considers that the commonest infective agents are Indian **hides**, Persian **wool**, and Chinese **horsehair**; but the infection has been introduced by Persian **mohair** and **alpaca**,

<sup>1</sup> *Wien. klin. Wochensh.*, January 15, 1914, p. 63.

<sup>2</sup> Annual Report of H.M. Chief Inspector of Factories, 1911.

<sup>3</sup> *Ibid.*, 1902.



Turkish and Russian camel mohair, and Russian and South American horsehair.

The dyeing of mohair tends to destroy the spores, which are very resistant.

The bacilli and the spores are the direct cause of infection. The former are easily killed, and can only be directly inoculated from an infected animal; the latter retain their vitality for years under many adverse conditions, and are readily conveyed by fomites.

A leading article<sup>1</sup> reviews the opinion of the Anthrax Investigation Board of Bradford; this latter states that blood, blood-clots, and dried scales are the usual carriers of anthrax infection. One of the best safeguards against the disease is "wet-salting" the fresh hides previous to packing.

The anthrax bacillus effects an entry into man through the skin, lungs, and the alimentary canal, from which points it may become generalized. This latter condition is rapidly and constantly fatal in a day or two. In any suspected case a bacteriological examination should be at once instituted, or some small animal inoculated.

Anthrax presents two types in the skin, the localized and the diffuse. In the latter, or malignant variety, local pustules are rare, and are replaced by a rapidly spreading erysipela-toid, dark-coloured rash, with brawny indurations.

In the former, the localized type, four somewhat indefinite stages are described: The incubation, or first stage:—is from one to three days; second stage:—vesicular formation, twenty-four to thirty-six hours; third stage:—inflammation, induration, and œdema, one to two days; fourth stage:—gangrene and sloughing.

Eurich<sup>2</sup> states that "the localized sore begins twenty-four hours after inoculation, and is fully developed in three or four days. In its early stage it is often mistaken for acne, and

<sup>1</sup> *Lancet*, 1914, vol. i., p. 625.

<sup>2</sup> Knocker, "Accidents in their Medico-Legal Aspect," 1910, p. 89.

may pass unrecognized. It is introduced through an abrasion in the skin, and commences as a pustule, with a predisposition to necrosis. Each boil is surrounded by other pimples; the centre of each boil mortifies, turns black, and is surrounded by a hard and reddened infiltrated area." In other instances a row of red nodules develops upon an infected scratch, capped by small pustules, some of which are covered with blood.<sup>1</sup>

Legge<sup>2</sup> gives the following figures relative to the position and frequency of the skin lesions :

Face and forearms were primarily and chiefly affected in 248 out of 261 cases. In all these the original lesion was an external pustule.

Head and face	...	45.5 per cent.		Neck	...	...	41 per cent.
Upper extremity	...	12	„		Trunk	...	1

The infection was conveyed by the agency of the dust in the work, in every instance.

In the hide and skin industry, out of 923 cases collected by W. Koch, the percentages show—

Head and face pri-				Trunk	...	...	3 per cent.
marily affected	...	48 per cent.		Neck	...	...	4
Upper extremity	...	40	„		Lower extremity	...	2

As long as the condition remains local, prognosis is favourable, and cure takes place within a fortnight. In this stage there should be drastic treatment in the form of an excision, or the injection of some strong antiseptic into the tissues around the pustules, and further, according to Eurich,<sup>3</sup> the employment of Sclavo's anti-anthrax serum.<sup>4</sup>

<sup>1</sup> *Arch. f. Derm. u. Syph.*, October, 1902, p. 303 (Ext.); *Brit. Journ. Derm.*, 1903, vol. xv, p. 226.

<sup>2</sup> Annual Report of H.M. Chief Inspector of Factories, 1904.

<sup>3</sup> Knoch, "Accidents in their Medico-Legal Aspect," 1910.

<sup>4</sup> Illustrations of anthrax in the skin are to be found under their appropriate heading in :—Schamberg, "Diseases of the Skin"; Jacobi's "Dermochromes"; Besnier, Brocq et Jacquet, "La Pratique Dermatologique,"

### Glanders.

**Glanders**, or equina, affects the horse, ass, mule, and jennet, and is communicable from these animals to man. *Stable-boys, coachmen, carters, cavalry soldiers, cabmen, and veterinary surgeons* are liable to be inoculated by the discharges from the nose, eyes, and skin of affected animals. The cause of the disease is the *Bacillus mallei*. Leslie A. Roberts<sup>1</sup> gives a good account of the disease.

Inoculation usually takes place through some trifling unobserved scratch or abrasion; the incubation period varies from three to five days in the acute form. When contracted through the skin, glanders is characterized by a rapidly spreading, dusky, erysipelatoid inflammation, upon which bullæ speedily develop. The skin soon becomes necrosed and ulcerates; numerous abscesses appear in different parts of the body. This acute attack is marked by high temperature and a pyæmic course, with grave constitutional disturbances.

According to Drs. Hallopeau and Jeanselme,<sup>2</sup> the chronic form often begins on the skin as a circular nodule the size of a pin's head, or a small pea. This may either enlarge slowly to form a tumour, the so-called "farcy bud," or may slowly ulcerate. The glands enlarge, and the lymphatics become corded. A series of nodules, or buds, may develop in the course of the lymphatic vessels. The farcy buds sometimes become quiescent, and may remain for years in this condition.

In this, the chronic type of glanders, it exists as an infective granulomata. The original sore, or the farcy bud, may break down and ulcerate, or the series of the latter suppurating may

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1900, tome i., p. 556; and in other books germane to the subject. Dr. Legge shows a very detailed table of the seventy cases reported during the year in the Annual Report of the Chief Inspector of Factories, 1913.

<sup>1</sup> *Brit. Journ. Derm.*, 1908, vol. xxi., p. 72.

<sup>2</sup> *Ann. de Derm. et de Syph.*, 1893; also *Brit. Journ. Derm.*, 1893, vol. v., p. 250.



discharge through sinuses and form typical chronic ulcers. These appear as if they had been punched out, with undermined margins, their bases covered with a yellowish viscid secretion, which often has a foul odour. These chains of nodules, or buds, running in a consecutive line may appear in the course of any lymphatic vessel, say on the inside of the thigh, or along the flank, both of which are favourite situations, as are also the buccal and nasal mucous membranes. In the acute cases the farcy buds form within a few hours, and discharge a thin glary fluid. The temperature will keep persistently high, proving that general infection is established, or the internal organs are attacked. Corner and Hobday,<sup>1</sup> who have studied the subject very carefully, state that an acute attack may quite suddenly supervene upon the chronic condition without any warning.

The chronic form of farcy is easily mistaken for the corresponding granulomatous stages of syphilis or tubercle. The existence of possible infection, the peculiar character of the ulcers, and the presence of numerous subcutaneous or intramuscular abscesses, should always suggest glanders.

Acute glanders is usually fatal in less than a fortnight.

The duration of chronic glanders is most indefinite, and the condition may last for months.

The discharges from all ulcerated surfaces are highly infective.

The prognosis in cases of acute equina is very grave, nearly all the patients dying. Of those attacked with chronic glanders, half recover.

Directly glanders is detected in a horse, a few drops of *mallein* should be injected subcutaneously. A diseased animal will react severely to such a dose within forty-eight hours, whereas a healthy horse will be unaffected by it.

<sup>1</sup> Knocker, "Accidents in their Medico-Legal Aspect," 1910, p. 409.

### Actinomycosis.

According to Lambart,<sup>1</sup> actinomycosis is an infective disease due to the presence in the tissues of the *Discomyces bovis* (Blanchard, 1900) or *Streptothrix spitzii* (Lignières and Spitz, 1903). He says the disease can be transmitted from cattle to man, either directly from the diseased animal, or indirectly through the medium of **milk** or **uncooked meat**. Reliable instances come most commonly from **infected grain**. The usual site of inoculation is through a carious tooth, although the fungus may gain admission by the respiratory or alimentary tracts.

Delépine says that in 75 per cent. of cases actinomycosis is due to the occupation of the victim. L. Roberts<sup>2</sup> mentions *farmers, labourers, coachmen, grooms, and millers*, as being most frequently attacked by the disease.

It is only when the inoculation is direct to the derma that actinomycosis can be regarded as a skin disease. Albert found eleven undoubted cases of this description, and such instances are certainly very rare. The usual modes of ingress are through the mouth, nose, mucous membranes, and digestive and respiratory tracts.

Kopfstein<sup>3</sup> records the case of a woman, aged thirty-six, who worked as a farm labourer. Whilst peeling potatoes she cut her hand. At the end of a few weeks the skin round the cut became swollen and adherent. There was but little appearance of inflammation, and the glands never became affected.

The following case is given by A. Sichard<sup>4</sup>: A woman, aged thirty-nine, worked in the fields and had charge of

<sup>1</sup> Lambart, "Tropical Diseases," 1914.

<sup>2</sup> *Brit. Journ. Derm.*, 1908, vol. xxi., p. 72.

<sup>3</sup> *Wien. klin. Rundschau*, January 13, 1913; *Brit. Journ. Derm.*, 1901, vol. xiii., p. 193 (Abs.).

<sup>4</sup> *Presse Médicale*, August 15, 1903; *Brit. Journ. Derm.*, 1903, vol. xv., p. 419.

cattle. Whilst tying up some sheaves of wheat, a spike of corn cut her skin. Eight days later, the part became œdematous and she suffered acute pain, lasting forty-eight hours. A number of vesicules formed upon the hot, red, tender skin around the old cicatrix. Neither lymphangitis nor axillary adenopathy followed. An abscess slowly formed, which discharged a little pus and blood. Some secondary abscesses also developed in the near vicinity. Subsequently deep sinuses formed, with greyish sloughing and crateriform ulcers. The pus was always small in amount, but, despite this, the typical yellow granules were obtained. The condition was followed by periostitis and exfoliation of bone.

The lesions are primarily nodular in shape, with subsequent ulceration. The *Streptothrix*, or ray fungus, from which the disease originates, grows on herbs or grain and infects any open sore.

Pusey<sup>1</sup> gives an interesting illustration of actinomycosis, which is well worth inspection.

The following symptoms should always excite suspicion: Submental tumour, dusky and nodular suppuration from numerous sinuses. Carless<sup>2</sup> states that in children the condition sometimes shows a resemblance to sarcomatous masses.

It is very important that this disease should be borne in mind when diagnosing some doubtful tumour, abscess formation, or chronic ulceration.

### **Dermatomycosis: The Psoroptic or Dermatodectic Form of Mange (Roberts).**

According to Sequeira,<sup>3</sup> some varieties of the *microsporon*s not known to attack the human species have been found on the cat, dog, horse, and guinea-pig.

<sup>1</sup> "Principles and Practice of Dermatology," 1907, p. 637.

<sup>2</sup> *Brit. Journ. Derm.*, 1897, vol. ix., p. 474.

<sup>3</sup> "Diseases of the Skin," 1911, p. 115.



The *Ectothrix trichophytos*, on the other hand, when found on man, are derived from such animals as **horses, cattle, pigs, deer, cats, dogs, and birds**. Not only are they communicable to man, but they pass from one human subject to another, either directly or indirectly. They usually cause ringworm of the beard, body, nails, and only occasionally of the scalp. *Ectothrix* infection is summarized as follows by Sequeira. The common forms are—

1. A horse ringworm, which produces scaly rings on man. The cultures are yellow discs, showing rays at the margin.
2. A horse and cattle ringworm, which sets up inflammatory and suppurative lesions in man. The cultures are white and extremely luxuriant.
3. A cat ringworm, which initiates vesicles in rings in the human subject. The cultures are white discs with marginal rays.
4. A bird ringworm, with cultures of a rose-pink colour.

There is, further, a **mouse** favus with white cultures, similar to those of the microsporon, and a favus which gives a brown culture derived from the horse. Both of these attack the human subject, and are clinically indistinguishable.

Sequeira gives an illustration of the calf dermatophyte.<sup>1</sup>

Wild<sup>2</sup> describes cases of ringworm which were conveyed to men who use **straw** for packing. The disease appeared on the arms and legs, and was very severe. It is generally due to animal infection—horses or cattle. The lesion was usually single and markedly inflammatory, appearing in the form of raised, sharply defined discs or nodules, covered with small pustules—the folliculitis conglomerata of older writers (Adamson). One attack acts as a protection against a second. There is a tendency to spontaneous cure of the affection.

Roberts<sup>3</sup> says these ringworms are chiefly communicated

<sup>1</sup> "Diseases of the Skin," p. 118.

<sup>2</sup> *Brit. Med. Journ.*, 1913, vol. ii., p. 311.

<sup>3</sup> *Brit. Journ. Derm.*, 1909, vol. xxi., p. 72.

to *farmers, stablemen, servants, ostlers, and grooms*. Epidemics have been reported in horse regiments and in villages.

Friedberger and Fröhner,<sup>1</sup> in their study of the keratomycetes of domestic animals, note that ringworm occurs in the horse, calf, dog and cat. They believe the *Keratomycetes* of **calves** to be most commonly infective to man, and next in frequency from dogs, and that infection is more rare from the horse, goat, and cat.

Adamson,<sup>2</sup> in writing on this subject, says it may spread from mice to men, causing very severe reactions. The growth of these fungi is confined to the horny cells, but during its development poisons are liberated, which set up severe inflammatory reactions.

Roberts<sup>3</sup> is of opinion that favus occurs spontaneously, chiefly in rabbits, guinea-pigs, mice and birds. It is only occasionally communicated.

Sherwell<sup>4</sup> corroborated this latter fact, and a few authentic cases have been recorded, particularly from mice<sup>5</sup> and birds.

### Dermat-Ankylostomiasis.

**Ankylostomiasis** is due to a small parasitic worm, the *Uncinaria duodenalis* or *Ankylostomum duodenale*.

Boycott,<sup>6</sup> in his article on the subject, states that the disease can only occur in temperate climates amongst miners, as the eggs and larvæ require a temperature of about 70° F., and also moisture to hatch out and grow. In this country, so far, the chief victims are the workers in the Cornish lead-

<sup>1</sup> "Spezielle Pathologie und Therapie der Haustiere," Stuttgart, Seventh Edition, 1908.

<sup>2</sup> *Brit. Journ. Derm.*, 1913, vol. xxv., p. 309.

<sup>3</sup> *Ibid.*, 1909, vol. xxi., p. 72.

<sup>4</sup> *American Veterinary Review*, November, 1892.

<sup>5</sup> *Brit. Journ. Derm.*, 1914, vol. xxvi., p. 323.

<sup>6</sup> Knocker, "Accidents in their Medico-Legal Aspect," 1910, p. 83.

mines. Possibly coal-miners in warm, damp parts of England may rarely furnish sufferers. The disease is extensively prevalent in tropical countries, and is common on the Continent of Europe, where it is widely spread by the employment of Italian and Polish labourers.

The skin affection associated with the disease is known familiarly as **ground itch**, and in Cornwall as **bunches**. This occurs at the part of the skin where the full-grown larvæ pierce the skin to reach the small intestine and develop into the complete worm. The skin becomes greatly irritated at this point, and eruptions are produced, varying in degree from trivial pimples to severe boils, which may incapacitate the patient from work. Any of the exposed surfaces of the integument may be selected, but the extremities suffer most frequently.

Pusey<sup>1</sup> says the "ground" or "**toe** itch" sets up a violent vesicular dermatitis, which becomes pustular from infection, and is accompanied by great swelling and excruciating itching. The feet and hands are mostly affected. The dermatitis lasts from ten days to six weeks. If seen early, turpentine promptly relieves the itching.

Four illustrations of this disease are given by Smith<sup>2</sup> in an article on the subject.

### Insect Rash.

The cutaneous diseases resulting from insect parasites are numerous and varied. Thus, Professor Hobday<sup>3</sup> says that every species of domesticated animal, and many wild ones may contract parasitic mange. This is occasionally conveyed to man, in whom the parasite may live its life, but it never burrows when transferred to man, and as a rule does not propagate. There are usually but few symptoms.

<sup>1</sup> "Principles and Practice of Dermatology," 1907, p. 702.

<sup>2</sup> *Journ. Amer. Med. Assoc.*, 1906, p. 546.

<sup>3</sup> *Lancet*, 1913, vol. i., p. 1388.



**Mange** communicated to man from the **dog** or **cat** is sometimes mistaken for pruritus or eczema. The pruritus may be very troublesome; it usually appears as papules with black points, due to removal of the top of the papule by scratching, and the coagulation of a minute drop of blood. It sometimes also appears as a vesicular eruption. Whitfield recorded twenty-two cases in one of his papers,<sup>1</sup> and three in another.<sup>2</sup> Infection and reinfection are common occurrences.

In the cat this form of mange usually attacks the head first, spreading downwards to the neck and body. It can thus be easily recognized.

This disease is due to the *Sarcoptes* found in domestic animals. The female burrows under the skin in the original host.

Cases of human infection are recorded by Roberts.<sup>3</sup> Sarcoptic mange can also be caught from the **horse**.

Mange is produced in the dog by both the *Sarcoptes canis* and the *Demodix folliculorum*, and both of these, again, are contagious to man. The former is the more virulent to the dog, which loses all its hair and gives off a disagreeable smell from its body. According to Bunch,<sup>4</sup> a peculiar characteristic is that it always attacks the face in man, a part which is invariably free from *Sarcoptes homini*.

Bosellini<sup>5</sup> states that the acari from the bodies of **donkeys**, **goats**, **sows**, or **mules**, have been known to invade human beings. When they do so, however, no acari or burrows are found, though the irritation is sometimes great.

C. J. White<sup>6</sup> describes a condition which he calls "**brown-tail moth (*Liparis chrysorrhœa*) dermatitis.**"

<sup>1</sup> *Veterinary Journal*, November, 1912.

<sup>2</sup> *Ibid.*, February, 1914.

<sup>3</sup> *Brit. Journ. Derm.*, 1909, vol. xxi., p. 72.

<sup>4</sup> *Lancet*, 1909, vol. i., p. 966.

<sup>5</sup> *Giorn. Ital. d. Mal. Ven. e della Pelle*, fasc. i., 1905 (Abs.); *Brit. Journ. Derm.*, 1905, vol. xvii., p. 347.

<sup>6</sup> *Journ. of American Dermatological Association*, 45th year, p. 1027.

John C. Thresh<sup>1</sup> states that other insects in the pupa stage cause an urticarial rash on school children and entomologists.

J. R. A. Davis<sup>2</sup> says the puss moth (*Cerura vinula*) possesses a gland in the front part of the body which secretes an irritant fluid.

The barbed hairs and skin secretions of the larva of the *Porthesia auriflua* (gold tail moth) have also an evil reputation.

The long brittle brown hairs on the caterpillar of the fox moth (*Lasiocampa rubi*) produce very unpleasant irritation on thin parts of the skin; and also three species of *Chenilles processionnaires*. The irritation is caused by the barbed hairs, and sometimes by the cocoons.<sup>3</sup>

Stelwagon<sup>4</sup> mentions the *Dermanyssus avium* and *gallinæ* (bird mite or chicken louse) as occasionally attacking the human integument and provoking a varying degree of erythematous and papular irritation, which is intensified by scratching. The parasite is about the size of a grain of sand, and greyish-white in colour. It has six jointed legs, no antennæ, but strong mandibles. These insects are sometimes a great pest amongst fowls, and afflict those who attend to them, the hands and forearms being chiefly attacked.

Ticks, Shipley says, are "mites writ large." Apart from the fact that some of them spread protozoal disease, he mentions<sup>5</sup> the troublesome skin affections, such as vesicles and pustules, which their bites produce in *soldiers, travellers, and natives*.

**Erythema Autumnale** (harvest rash, prurigo du rouget, mower's mite).—This condition is not, according to Thresh,<sup>6</sup> caused by the harvest spider or bug, but a mite which is para-

<sup>1</sup> *Lancet*, 1906, vol. ii., p. 291.

<sup>2</sup> "Natural History of Animals," 1903, vol. ii., p. 359.

<sup>3</sup> *Brit. Journ. Derm.*, 1909, vol. xxi., p. 249.

<sup>4</sup> "Diseases of the Skin," p. 1069.

<sup>5</sup> *Brit. Med. Journ.*, 1914, vol. ii., p. 830.

<sup>6</sup> *Lancet*, 1906, vol. ii., p. 1277.

sitic upon it, the larva of a *Trombidium*. The harvest spider is found chiefly near the seashore, where the soil is light. Its seasonal appearance is July and August. Great numbers can be seen crawling over all green things—grass, corn, turnips. It is of a bright brick-red colour, and is scarcely visible to the naked eye. Large epidemics, said to be due to the bite of this insect, have occurred in France.

**Grain Itch.**—The acarus of grain itch is the *Pediculoides ventricosus*, and there are numerous accounts of the disease from France, Germany, Russia, and America (Philadelphia). Whenever this mite is present, other grain-destroying insects abound. This spider is of economic importance, as it destroys the larva of several insects which prey upon grain—for example, the wheat-straw worm, joint worm, and the grain moth. Mr. Stanley Hirst,<sup>1</sup> of the British Museum, says “that the mites of the family *Tyzoglyphad*, are often present in great quantities in cheese, cereals, copra (the dried kernels of the coconut), and sometimes cause grocer’s itch. These acari are not of the same genus as the common itch. The water itch of the coolies on Indian tea plantations belongs to this genus.

This acarus never burrows nor forms canaliculi in the human skin, but sets up a papulo-pustular eruption, with much itching on the arms, legs, and trunk, never on the face.

Schamberg<sup>2</sup> describes epidemics of grain itch in Philadelphia. They were first noticed in 1901, the eruption occurring as household epidemics, and appearing as a widespread urticarial irritation, with intense itching, mild fever, slight leucocytosis, and moderate eosinophilia. The primary lesion is a wheal surmounted by a vesicle, which soon becomes pustular. The mite infested certain straws, and spread to those who had to work amongst this straw, especially when

<sup>1</sup> *Brit. Journ. Derm.*, 1913, vol. xxv., p. 21.

<sup>2</sup> Philadelphia, U.S.A., *Journ. Cut. Dis.*, February, 1911.



using it for packing purposes or mattress-making. It also attacked those who slept upon the infected mattresses.

This trouble was called attention to many years ago in France, Germany, and Russia, as affecting persons who were engaged in moving barley grain sacks.

Cases of this itch have been recorded, amongst others, by A. Ducrey, and Sterna,<sup>1</sup> as well as by J. Owner, Inspector of Factories.<sup>2</sup> (*Vide* p. 121.)

<sup>1</sup> *Monats. f. Prakt. Derm.*, January, 1910.

<sup>2</sup> Report on Compensation for Industrial Diseases, 1907, § 9670 *et seq.*

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